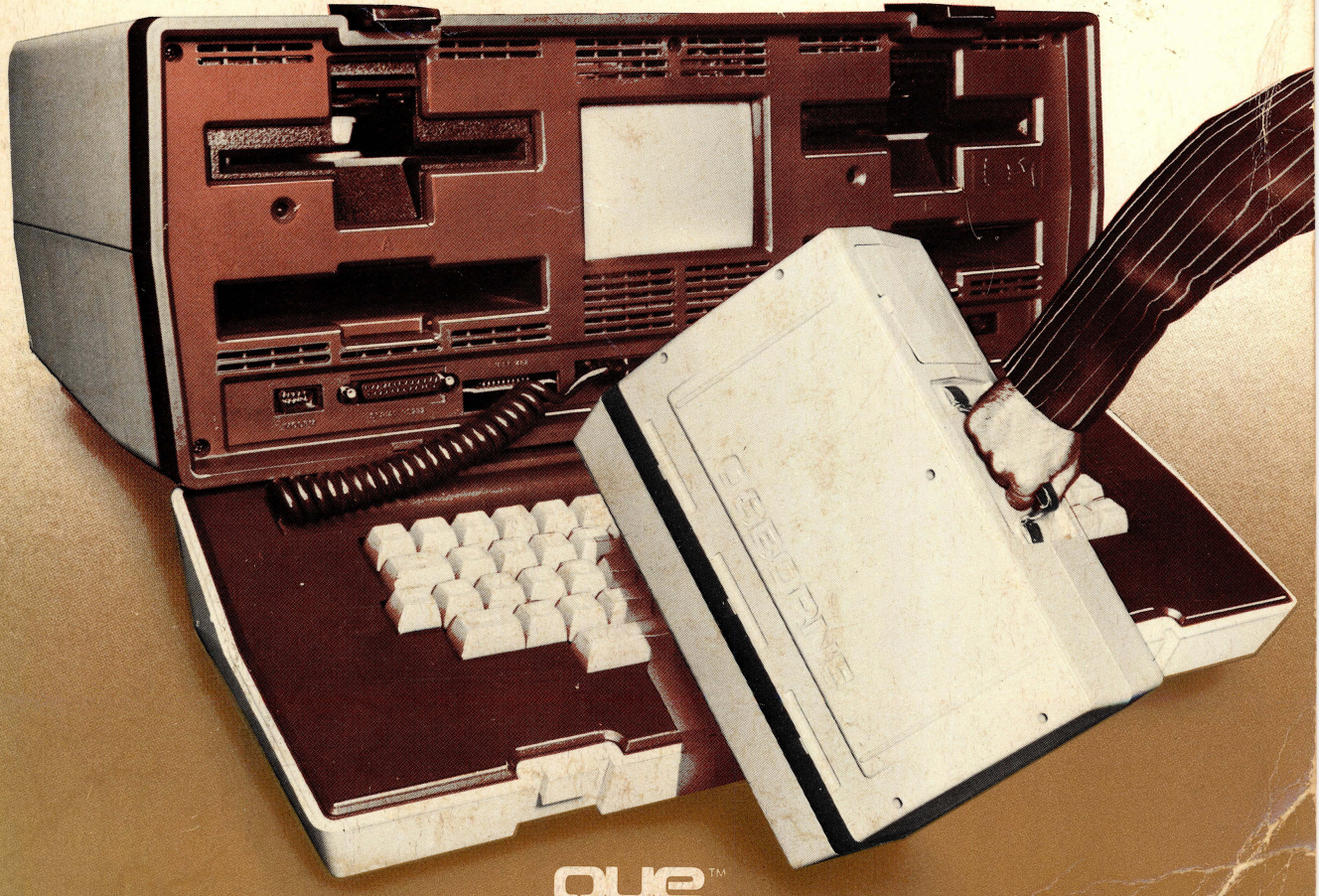
Que On Systems

THE OSBORNE

PORTABLE COMPUTER



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Thomas B. Henderson

Que Corporation
Indianapolis

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To Carol Pruden Henderson, who supplied endless cups of coffee and emptied my ashtrays without complaint.

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Introduction

In recent years the microcomputer industry has literally exploded, with new products being introduced daily. Keeping track of the information about these products would take an army of, well, computers. Our desire in this book is to present clear, concise, and fundamental information about the Osborne 1 portable computer.

The level of technical information in the *The Osborne Portable Computer* is purposely varied for a broad audience — as broad as the experience of shoppers for the Osborne 1. Parts of the book may serve as an introduction to microcomputers for those who might have been drawn to the field for the first time by the Osborne 1 itself. Other parts of the book present information more technical in nature for those who are already knowledgeable about computers.

The Osborne Computer Corporation, manufacturer of the Osborne 1, surprised the industry with the introduction of this revolutionary product and marketing strategy. Never before had a microcomputer and significant software been bundled at such an attractive price. Since the introduction of the Osborne 1, OCC's marketing approach has been imitated by several companies that have produced "Osborne clones" by manufacturing portable computers with bundled software.

Although the Osborne 1, as a portable, was not designed for applications requiring large disk storage capacity, this innovative computer has features that are highly regarded by the microcomputer industry.

Most of this book was composed on a first-edition Osborne 1 portable, then transferred electronically to Que Corporation's IMS computer. The Osborne 1's communications capabilities are representative of many others offered by this new kind of computer. That a portable computer should have so many capabilities has captured the attention of the computer world. If you also are intrigued by the versatility of this portable machine — read on!

Thomas B. Henderson

Chapter 1
Microcomputers and the Osborne 1

Writers often gaze into technology's crystal ball to predict what revolutionary impact microcomputers will have on life in America. Some articles claim that almost every home will have a microcomputer by 1990; others conjecture that "telecommuting," or doing office work at home by microcomputer, will radically alter the structure of current offices. Still others predict that schools as we know them will disappear within ten years. Such articles are fascinating to read, but only time will tell whether microcomputers will change society so radically in the next several decades.

The growth of the microcomputer industry, however, has been unquestionably revolutionary, considering that microcomputer systems did not exist ten years ago. Some analysts estimate that total sales in the personal computer industry will reach five billion dollars by 1985! This phenomenal growth continues despite economic sluggishness. Even the definition of "microcomputer" changes almost monthly as developments reshape the many roles of this small machine.

The Osborne 1 computer is itself revolutionary for establishing two trends in the microcomputer marketplace: extensive packaging of software with the computer and *portability* through self-contained hardware. Both innovations are covered in depth in this book.

Although the microcomputer industry is future-oriented, it has a history; and a few words about the past provide a background for appreciating the Osborne 1 computer.

A Brief History of Microcomputers

Microcomputers became possible in the early '70s when the Intel Corporation introduced its 4004 calculator chip. The 8008 and 8080 microprocessor chips followed within two years. Whether the 8080 chip itself launched the microcomputer revolution is debatable; however, the impact of the 8080 CPU (central processing unit) is undeniable. With the advent of silicon chip technology, the huge central processing unit of computers was miniaturized to the size of a postage stamp. Thus, extremely small computers — "microcomputers" — became possible.

Computer Kits

Microprocessor chips like the 8080 did not bring on an immediate revolution. The earliest microcomputers were merely kits that electronic hobbyists put together. Applications software — programs that do specific tasks like accounting, planning, or word processing — did not exist. Most of today's microcomputers are recent productions less than five years old.

Altair/MITS was the first company to market successfully a computer-in-a-kit. Based on the 8080 CPU, the kit consisted of several boards, each having a different function. All the boards were placed into a motherboard, where the 100 different connections of each board were joined by a common bus, a pathway for electrical signals. This computer was one of the first to use both the 8080 CPU and the S-100 bus, the foundation of many of today's larger microcomputers. The kit was successful even though it took much time to assemble.

Appliance Computers

The inconvenience of making a computer from a kit was eliminated by the advent of the "appliance computer" in the mid-1970s. A major obstacle — soldering the components together — was removed by Radio Shack with the TRS-80 Model I™, Apple Computer with the Apple II™, and Commodore Business Systems with the PET™ computer. A new owner could take home an appliance computer, connect it to a wall socket and television set, and have in a short time a working microcomputer system.

Microcomputer Limitations

Like any new industry, the microcomputer industry in the late 1970s lacked maturity. As was true for video cassette recorders (VCRs), few, if any, standards had emerged. Mechanical memory, often called *mass storage,* which "permanently" stores programs and data, ranged from inexpensive and painfully slow tape recorders to floppy disks and even to huge hard disks.

Prewritten software, ranging from games to word processing and business applications, was in short supply and uneven in quality. Software written for one company's computer could rarely be used on other computers made by that company. Most programs could not communicate with (use the data generated by) other programs even on the same computer. It is no wonder, therefore, that programs stored on mass storage media were generally incompatible with programs written by another manufacturer.

This problem of software incompatibility lessened when one program, VisiCalc®, became so popular that it was translated (rewritten) to work on many computers. This event, the creation of widely compatible independent software, was a milestone in the development of the microcomputer.

A current trend in software design is to allow other kinds of software packages — for example, accounting software — to interact with programs like VisiCalc. However, the interchange of data among different computers is still inhibited by a lack of standards in the mass storage media, the floppy diskette.

Into the thick of a multibillion dollar industry that continues to seek its own identity and definition entered Adam Osborne.

The Contribution of Adam Osborne

The appearance of hundreds of new microcomputer companies produced a need for information on how microcomputers work. In 1976 Adam Osborne wrote a book called *Introduction to Microcomputers.* This book became so popular that he wrote eight more volumes in a series.

The Importance of Available Software

Osborne responded to the explosive growth of the industry and its failure to acknowledge certain needs. In his monthly column, "From the Fountainhead," in *Interface Age,* he often observed that a microcomputer's usefulness is directly related to the availability of its software.

Many sophisticated or unique programs work on only a few computers. The translation of the programs for use on other systems is difficult. Some microcomputer manufacturers compound conversion difficulties by withholding from programmers vital information about the programs or the computer systems.

The Value of a Self-Contained System

Many microcomputers need additional equipment to make the system fully usable. Equipment like plug-in boards are not difficult to install, but recall the days of computer kits.

A comparison of an Apple II computer with the Osborne 1 shows the value of having the necessary hardware in one, self-contained unit. For an Apple II to be like the Osborne 1, the following equipment would have to be acquired. Each item must be purchased separately.

- An Apple II 48K computer
- Two Apple Disk II™'s with a disk controller card
- A video monitor and connecting cable (or a TV set with an RF modulator)
- An RS-232 interface card
- An IEEE-488 interface card
- A Centronics parallel interface card
- An Apple Language Card™ or similar 16K RAM add-in card

In a comparison of the two computer systems, certain important differences are evident. The Apple II can work with color; the Osborne 1 cannot. Software, especially for spreadsheeting, entertainment, and education, is more available for the Apple II. However, this Apple II system retails for $3,000+; the Osborne 1, for

much less. A further point in favor of the Osborne 1 is the bundling (inclusion) of application software with the hardware at no extra charge.

The Identification of Five Fundamental Needs

Seeing the market's inability to accept the industry's shortcomings, Adam Osborne formed the Osborne Computer Corporation to produce a computer system that would take advantage of reliable microcomputer technology. In an article in the April, 1981, edition of *Creative Computing Magazine,* Osborne identified five important needs:

1. Affordability
2. Simplicity with versatility at the expense of expandability
3. Portability
4. Software compatibility through standardized operating systems and languages
5. Software marketability through friendliness to vendors

The Osborne 1 Computer

The five Fundamental needs identified by Adam Osborne are met by the Osborne 1 microcomputer.

Affordability

First of all, the Osborne 1 is a "major price breakthrough." Although $1,795 is not idle cash, the Osborne 1 is the least expensive computer system with its capabilities. It is roughly half the price of many similarly configured microcomputers. The price breakthrough is also evident in the system and applications software included in the $1,795 price.

Simplicity

Second, the Osborne 1 is a straightforward microcomputer with little internal expansion capability. The RAM (random access memory, or user memory) is fixed at 64K, and typical expansion slots for using some additional devices are not provided. The merits of these limitations are discussed later in this chapter.

Portability

Third, most microcomputers fit comfortably on a desktop, but the Osborne 1 is portable. "Micro" means small, and the Osborne 1 more than satisfies any definition of a *micro*computer. With an optional battery pack, the Osborne 1 can be carried like a briefcase and is designed to withstand the rigors of travel.

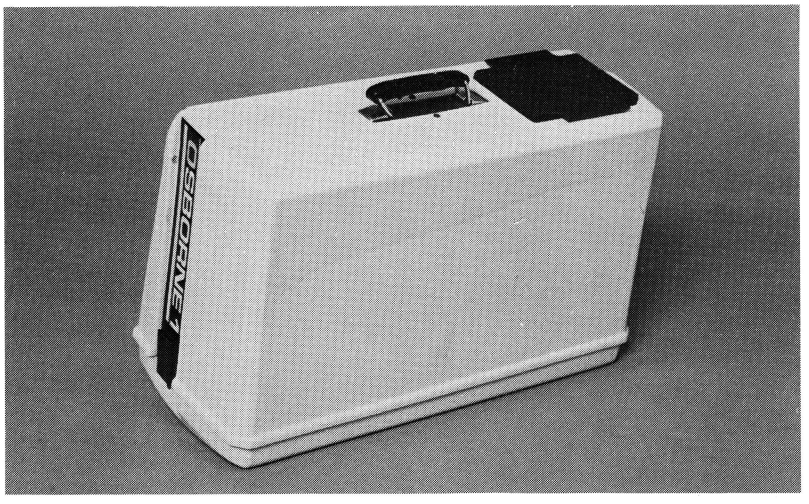
Software Compatibility

A fourth feature of the Osborne 1 is its use of standardized software for both the operating system and the programming languages. The Osborne 1 uses the standard CP/M operating system, Microsoft's BASIC-80 interpreter, and Digital Research's CBASIC programming language. These are discussed in detail in Chapter 4.

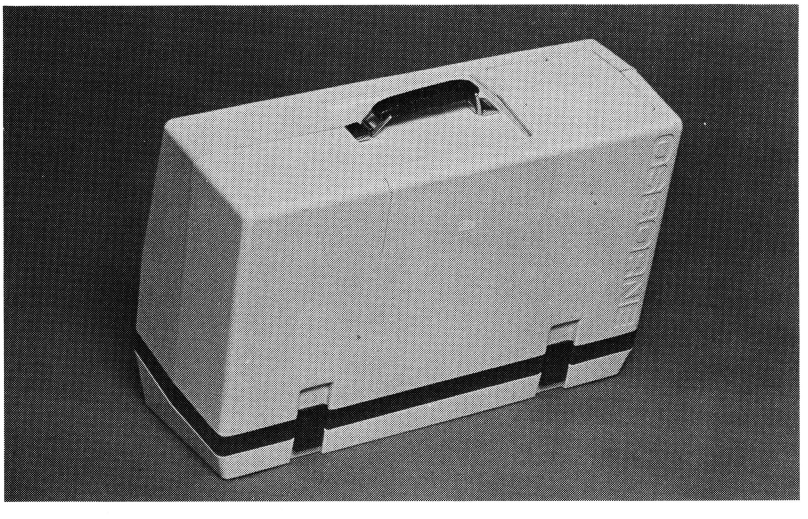
Software Marketability

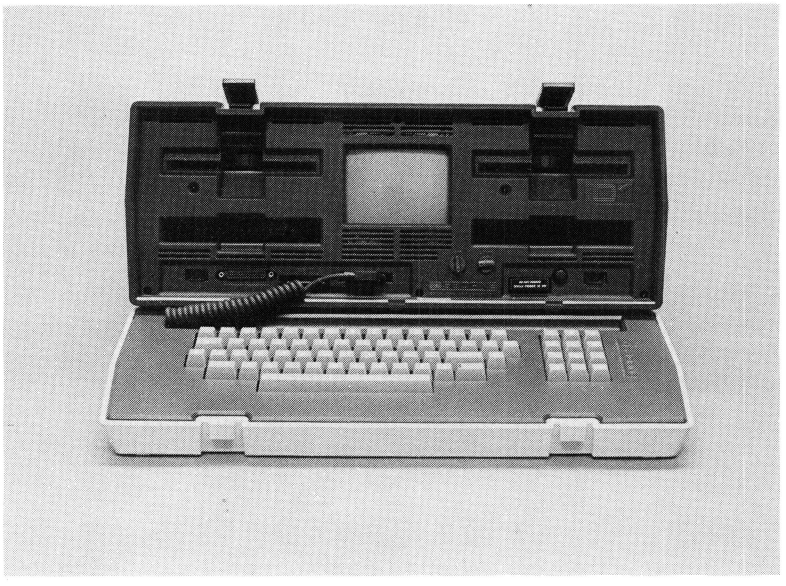
The fifth need identified by Osborne is friendliness to professional program writers, whose livelihood is writing and publishing programs. This need to offer a popular and secure vehicle for marketing programmers' products at an affordable price may not be evident to the microcomputer newcomer, but exists nonetheless. The cost of authoring and publishing a software product is immense. Custom programming costs range from $25 to $75 per hour. A sophisticated program like SuperCalc™ by Sorcim Corporation may take over two years to write. If such a program were written as a custom effort, the total price could exceed $2,000,000! However, when such an investment in software becomes amortized through mass marketing, such software products become affordable for consumers.

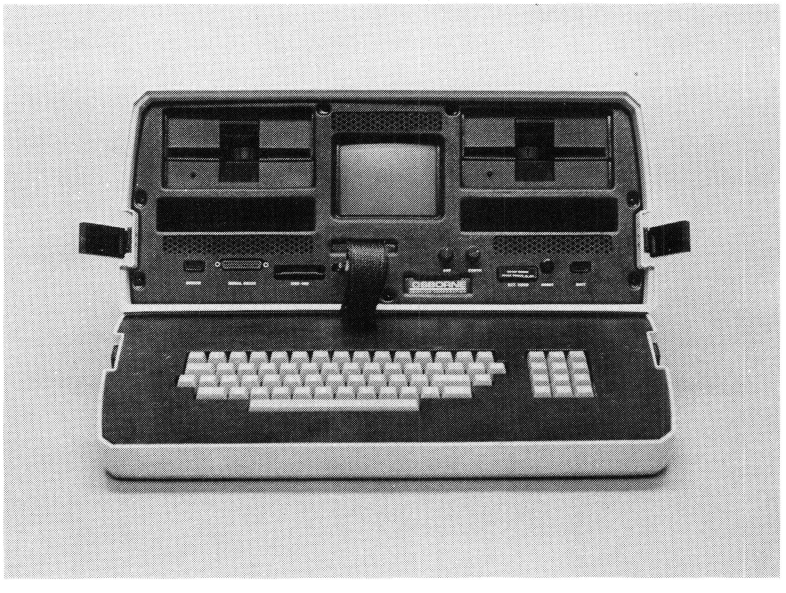
The markets for computers and software are interdependent. As more computers are sold, the need for quality software increases. When programmers respond to this need, the software marketplace fills with more software. As the marketplace becomes flooded, the prices for software become more competitive and therefore more affordable. The increase of available software has a positive effect on the sale of more computers. As more software becomes available for a particular computer, the amount of software "sells the computer." A well-known example is the Apple II computer. Many Apple II computers have been sold because buyers knew that much affordable software was available for the Apple. The Osborne 1

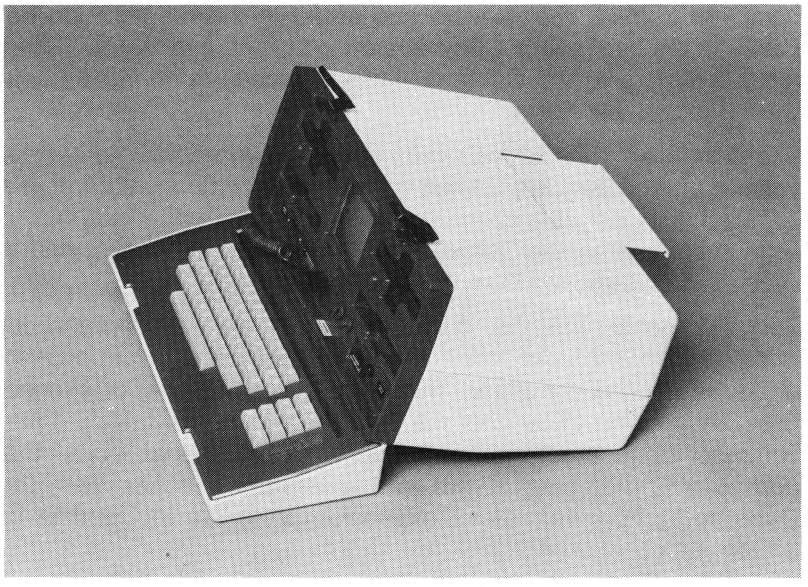


Exterior views of the older Osborne 1 case (top) and the current Osborne 1 (bottom). The most noticeable external differences between the two are the case color (tan versus grey) and the case catches (on the side of the unit instead of the front). Both units have a power well on top, but the new case has a sliding vent.









On the opposite page, the older model Osborne 1 (top) and the current Osborne 1 (bottom). The keyboard connector, located below the video displays on both systems, is connected to the keyboards by a flat, reinforced ribbon cable on the older model, and by a coiled cable on the current model. The models also differ in the position and size of the air vents and in the size of the pockets that carry the floppy diskettes. Above is a side view of the current Osborne 1 showing the air vent opened. The air vent on the top of the case should be open when operating the Osborne computer.

computer should, likewise, be successful in the marketplace because of the computer's CP/M operating system and BASIC, which make available to the Osborne 1 user a wealth of affordable software that already exists.

The Osborne 1 reflects the needs seen by Adam Osborne several years ago. The sensible design combines all component parts in a compact, truly portable computer. With five of today's most desired software programs, the Osborne 1 is the first fully capable computer system when removed from its single packing box.

The design offers flexibility in another important area: peripheral devices. Front panel jacks connect three of the most popular peripheral devices to the computer. The value of these jacks, or connections, may seem trivial until the time for expansion arrives. Other computer systems offer these connections as optional "ports" that add to the total cost of the microcomputer system. With the Osborne 1, however, these expansion ports are included in its $1,795 price.

Thom Hogan and Mike Iannamico, in the Osborne 1 owner's manual, explain that the Osborne 1 is a complete system, it cannot be purchased without disk drives or monitor.

The Osborne 1 satisfies the five basic needs that Adam Osborne saw in the microcomputer field in 1980, but the Osborne 1 does not fulfill all needs of the microcomputer or business user. How the Osborne 1 relates to the microcomputer industry and the business, educational, and home marketplaces is considered next.

Where the Osborne 1 Portable Fits

A logical question is, "While the Osborne 1 marks a major advance in microcomputing, how does it compare with other microcomputers?" Unless the user needs a microcomputer for entertainment with color graphics or requires large-scale computer capability, the Osborne 1 compares favorably.

The Osborne 1 fits the needs of many applications with its supplied software programs. The two most popular applications for personal computers, spreadsheeting (financial planning) and word processing, are satisfied by the inclusion of SuperCalc and WordStar. The

two most popular BASIC languages, Microsoft's and Digital Research's, also come with the computer.

Business Uses

The business community has used microcomputers conservatively, viewing skeptically this mushrooming sector of the new technology. This conservatism was probably compounded by the less-than-sterling reputation of early microcomputers for reliability and usability.

Recent developments are altering this view of microcomputers. A major event, the entry of IBM's Personal Computer into the microcomputer field, has added stature and credibility to the entire microcomputer industry. The interest of other reputable companies, such as Digital Equipment Corporation, Wang Laboratories, Monroe Business Machines, and Victor Business Machines, continue to legitimize the microcomputer field.

With these major names in the microcomputer marketplace, the business community has come to accept the microcomputer as a valuable tool. Sales have increased in all sectors, including the Osborne 1.

However, the Osborne 1 is designed as a limited machine. Its floppy disk storage and video display are limited. Companies seeking to use the Osborne 1 as a general-purpose business computer may find that the floppy disk drives, as supplied, are the principal limitation, because they are unsuitable for accounting. This limitation, however, does not preclude the use of hard disks with the Osborne 1, as discussed later. Furthermore, word processing on the 52-column by 24-line screen is awkward for those operators accustomed to 80 columns by 24 lines. Thus, the off-the-shelf Osborne 1 as a business system is suitable for only small businesses, or for limited applications in large businesses.

Nevertheless, the Osborne 1 does adequately address the largest single interest of personal computers in the business community — spreadsheeting. SuperCalc provides businesses with a powerful tool for financial planning.

With its unrivaled portability and price, the Osborne 1 benefits the traveling salesperson the most. Carrying the Osborne 1 like a brief-

case, salespersons can book orders in the field, perform local analysis with SuperCalc or some other custom program, then telephone these orders to the home office. The Osborne 1's telecommunications capability and ability in the field to generate price quotations and project accurate delivery dates make the portable Osborne 1 an important productivity tool.

The traveling executive can accumulate memos and letters in the portable Osborne 1 and print these documents on a letter-quality printer after returning to the office. The uses of a portable computer in business are endless.

With a CP/M operating system, the Osborne 1 makes available to the businessperson a large library of business software programs. This library includes a selection of mature and reliable software programs that the Osborne 1 owner may purchase. These programs, when possible, have been modified for the Osborne 1's video display.

In short, the Osborne 1 is not a traditional business system, but a portable, personal productivity tool.

Education Uses

Some colleges and universities require business students to own or lease microcomputers for their studies. Other institutions will move in this direction as computer literacy becomes a prerequisite in the job market. This requirement, and the long lines students wait in to use university computer equipment, make the Osborne 1 a timely solution.

The supplied software and large user memory adequately handles most students' computing tasks. Computer science majors may find the Osborne 1 sufficient for introductory courses. Later, the computer's telecommunications capability makes the Osborne 1 an excellent "smart" terminal. A student may author programs on the Osborne 1, telecommunicate these programs to and from the university's mainframe computer, and operate the finished program on the larger computer to complete assignments. The concept of "local" editing of programs on the microcomputer has great appeal among business and education institutions, for it frees the resources of the larger computer for more productive tasks.

The $1,795 price of the Osborne 1 is not a trivial matter for a student's budget. However, the Osborne 1 as a computer is a sound investment when coupled with the provided software. The portable Osborne 1 can be in the classroom during the day, do homework at the dormitory or apartment at night, and travel home on weekends.

Color graphics in such computers as the Apple II, the Commodore Vic 20™, and the Vic 64™ make them dominant in elementary education. Color and sound attract youngsters to computer-assisted instruction and computer literacy. Without these capabilities, the Osborne 1 will not find a similar home in this field. However, microcomputers without color and sound can find popularity in education. Enjoying such popularity are the Radio Shack TRS-80 and the Commodore PET and CBM™ computers. Especially in the area of computer literacy, computers like the TRS-80, PET, and Osborne 1 have significant places in the educational process.

Home Uses

The computer that will be in **every** home has not been invented. Although journalists enjoy spinning tales of grandmothers balancing their checkbooks with computers, the cost of microcomputers is a large investment, not to mention the skill required to program the system. The Osborne 1 is less expensive than most, and its supplied programs and computing resources make it an excellent value. But the ideal place for storing recipes is still on index cards, and phone numbers are still best kept in small, pocket-sized directories. Neither the Osborne 1 nor any other microcomputer of its capability will find its way into fifty million homes at Christmas.

One should not, however, belittle the use of a personal computer in the home. The software that makes the Osborne 1 useful in business also makes the computer of value at home. Both SuperCalc and WordStar may be used as productively at home as at at the office. The spreadsheet can calculate a personal budget, aid in estate planning, and project household expenses. Although families will find the $1,795 significant, the Osborne 1 is more affordable than its competitors. And its portability may make it the ideal system for the businessperson's desk during the day, and for the kitchen table or den at night.

Recent Innovations in the Industry

Extensive media coverage has recently been given to 16-bit microcomputer systems. These new systems use designs based on the Intel 8086 and sister 8088 processor. The Motorola 68000 and Zilog Z8000 families offer superior capabilities. These central processing units represent the most recent advances in technology.

The Osborne 1 computer does not use a 16-bit CPU, whose speed and capabilities offer minicomputer-like power at microcomputer prices. Instead, the Osborne 1 computer uses an 8-bit processor, the Zilog Z80. Are the capabilities of the Osborne 1 limited by the absence of up-to-date, l6-bit technology?

The answer is both "yes" and "no." The Osborne 1's hardware system design is obsolete in the sense that — as one electronic technology spokesperson put it — every computer system sold today is obsolete, because technology is constantly developing. Much time, however, is needed to engineer the latest technological developments into a working computer system amply tested and ready for the marketplace. Therefore, computers that are currently available will be of value for some time, and a computer shopper should not refrain from making a selection.

Concerning available software, computers using an 8-bit microprocessor, such as the Osborne 1's Z80, have an established and mature software base. The time needed to develop this base is typically 2 to 4 years; therefore, the 16-bit systems have not reached the level of maturity already obtained by the 8-bit microcomputers. This does not mean that 8-bit system software is better software, for the 16-bit systems inherently have more available computing power and should obtain in software a state of maturity and power beyond that of 8-bit systems. However, it will take several years before this maturity in 16-bit software is realized.

Perhaps the best way to end the debate over 8-bit and 16-bit microcomputer systems is to look at current software. Most of it is for 8-bit computers. Systems like the Osborne 1 have an established lead.

Summary

Two words sum up the value of the Osborne 1 computer: portability and price. The Osborne 1 is the first truly portable computer, a computer in a briefcase. It is also the first to bundle important applications software with the computer system at a historically significant price of $1,795.

Adam Osborne's goal — to design and sell a portable, limited computer with a standard operating system and programs for an unfulfilled market — was fulfilled by the Osborne 1.

Throughout the following chapters, the strengths and limitations of the Osborne 1 computer are discussed. The Osborne 1 computer cannot fulfill all microcomputing tasks. The system is not designed for use by more than one person at the same time to do different tasks (i.e., to be a multiuser, multitasking system). The mini-floppy diskette capacity may be insufficient for some accounting or data base uses. Furthermore, the 52 x 24 video display may be disquieting to some operators.

Those who consider such limitations significant and require high capacity for storage should look for some other computer. But those who find the Osborne 1's computing power adequate will discover that the Osborne 1 computer is a sound, value-based investment.

Chapter 2
The Osborne 1 System

Two kinds of systems have developed in the design and construction of microcomputers: the traditional system and the all-in-one system. In a traditional system, individual devices, such as the video display, the keyboard, the disk drives, and the CPU, are enclosed in separate boxes connected with cables. In an all-in-one system, most, or all, of these devices are combined in one box.

The most popular "appliance" computers are, like the Osborne 1, all-in-one systems. However, the Osborne 1 is different physically because it is designed for portability. As a portable computer, the Osborne 1 differs also from current hand-held pocket computers, because of its greater size and more powerful computing capabilities.

General Physical Features

Pointing to a 19-inch "portable" color television weighing 79 pounds, a television salesperson once quipped, "Just because it has a handle doesn't mean a TV is portable."

Light Weight

Obviously, the Osborne 1 cannot compete in weight with hand-held computers, but its advantages become evident in comparisons with other microcomputer systems. The Osborne 1 is quite light, considering that its 24 pounds include a video screen, two mini-floppy

diskette drives, a keyboard, a power supply (normally the heaviest component of a computer system), and a system board. Although the Osborne 1 is too heavy to carry a great distance, this portable computer is light enough for travel between the office and home, or on the road.

Table 2-1
Weight of the Osborne 1 and Key Components

Total system	24.00 pounds	10.90 kilograms
Key components		
System board	1.19 pounds	.54 kilograms
Keyboard	1.38 pounds	.61 kilograms
Disk drives (each)	3.25 pounds	1.48 kilograms
Monitor assembly	3.38 pounds	1.53 kilograms
Power Supply (including plug and fuse plate)	1.38 pounds	.61 kilograms

Rugged Construction

The ruggedly constructed Osborne 1 used for writing this book traveled by air, car, and motorcycle over 10,000 miles without a transportation-related failure. Only a few scratches and some dirt marred the case — a small consequence for the miles traveled.

An article in the first edition of *The Portable Companion,* the bimonthly magazine published by Osborne Computer Corporation, told of "tests of durability" for the Osborne 1 that even a major watch company might want to avoid. For example, an Osborne 1 computer, not wearing a seat belt, traveled through the front windshield of a suddenly stopped car. Another unit was dropped by its owner down four concrete steps. The author of the article accidentally "drop kicked" his unit off a raised platform. In each instance, the Osborne 1, like the popular watch, was functional after the ordeal and suffered only scratches.

Limitations and Improvements

The article reminds the user that, although the Osborne 1 is ruggedly constructed, it is not a piece of Samsonite™ luggage.

The Osborne 1 unit is weather-resistant, but not weatherproof. When closed and resting upright, the computer can shed rain. However, the unit cannot withstand continued exposure to the elements and will not tolerate the elements at all if the case is open.

Table 2-2

Physical Dimensions of the Osborne 1

Case closed:		
Height:	9.0 inches	22.9 cm
Width:	20.5 inches	52.0 cm
Depth:	13.0 inches	22.7 cm
Case open:		
(keyboard lip placed under computer)		
Height:	10.25 inches	26.0 cm
Width:	20.5 inches	52.0 cm
Depth:	20.0 inches	50.8 cm
(top vent closed)		

An older styling, no longer available, could not take shock, abuse, or the stress of rough handling as well as the new model, which has a stronger plastic case and a coiled keyboard cable.

In both units, the keyboard can be separated from the main unit. The older unit's flat "ribbon" cable, armored with a metallic braided shield, allowed the placement of the keyboard no more than 12 inches from the front of the unit. The coiled cable on the new model extends that distance by several inches.

The Osborne Computer Corporation has improved the portability of its computer by mounting all controls, jacks, knobs, and disk drives on the front panel. Although the computer looks like an octopus if all six jacks are used at once, this design makes the jacks accessible and protects them from dust and dirt during transportation. Jacks are placed at the rear of most desktop computers, and a user has to "hunt" for the jack needed. The front panel design of the Osborne 1 allows rapid connection of cables and attachments.

The Osborne 1, by design, is a portable computer. The system can be easily transported and can withstand the normal stress of travel.

However, the Osborne 1's many capabilities cannot be appreciated without an examination of its internal hardware.

Inside the Osborne 1 Computer

Located in the bottom of the Osborne 1 is the system board, the main circuit board of the Osborne 1 computer. The Osborne 1 follows the design trend used by such manufacturers as Apple, Tandy, Xerox, and Zenith, which place most of the computer's circuitry on the system board.

The System Board

The system board of the Osborne 1 contains the Z80A **CPU** (central processing unit), the **ROM** (read-only memory), and the **RAM** (random access memory). The electronic circuits for the keyboard, video display, input/output, and beeper are also located on the system board. The design of the system board is unusual in one respect: the system board also houses the disk drive controller circuitry and the physical connections for the I/O ports.

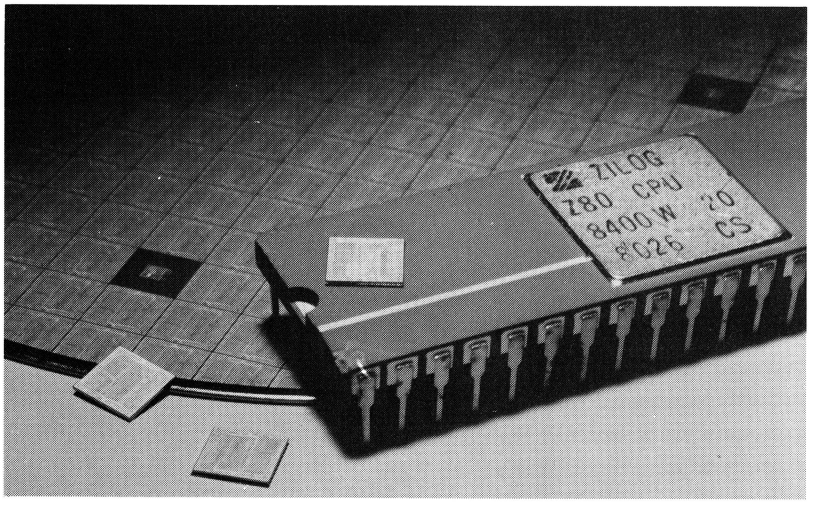
Most microcomputer systems require the purchase and installation of a disk controller board, which is an interface card that connects the computer to the disk drives. The Osborne 1 system board contains this circuitry. The front of the board contains all the edges and plugs for the various input/output connections. These connections protrude through the front panel of the Osborne 1. By incorporating all major electronic components and I/O ports in the system board, the Osborne 1 computer achieves both compactness and economy.

The power of a computer system is related both to the power of the CPU and to size of the RAM memory. A discussion of both components is helpful for an understanding of the Osborne 1's power.

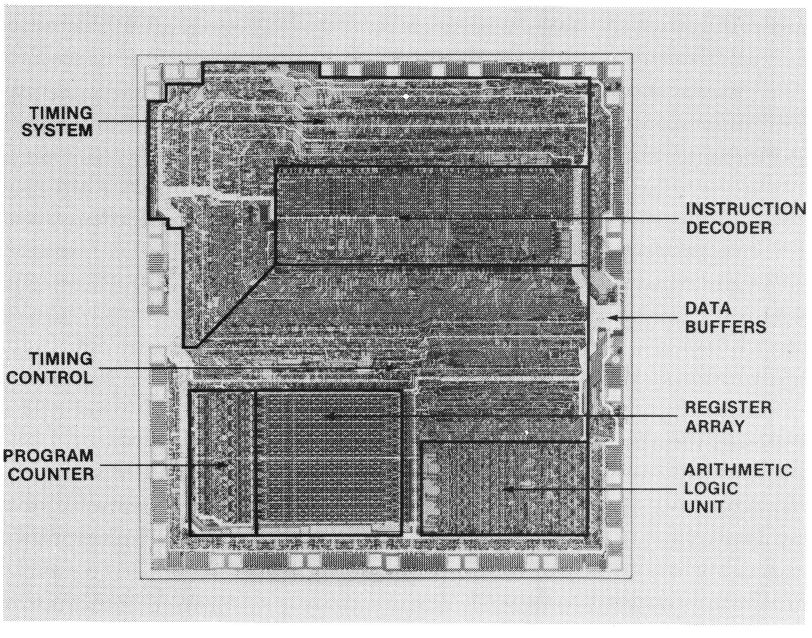
The CPU

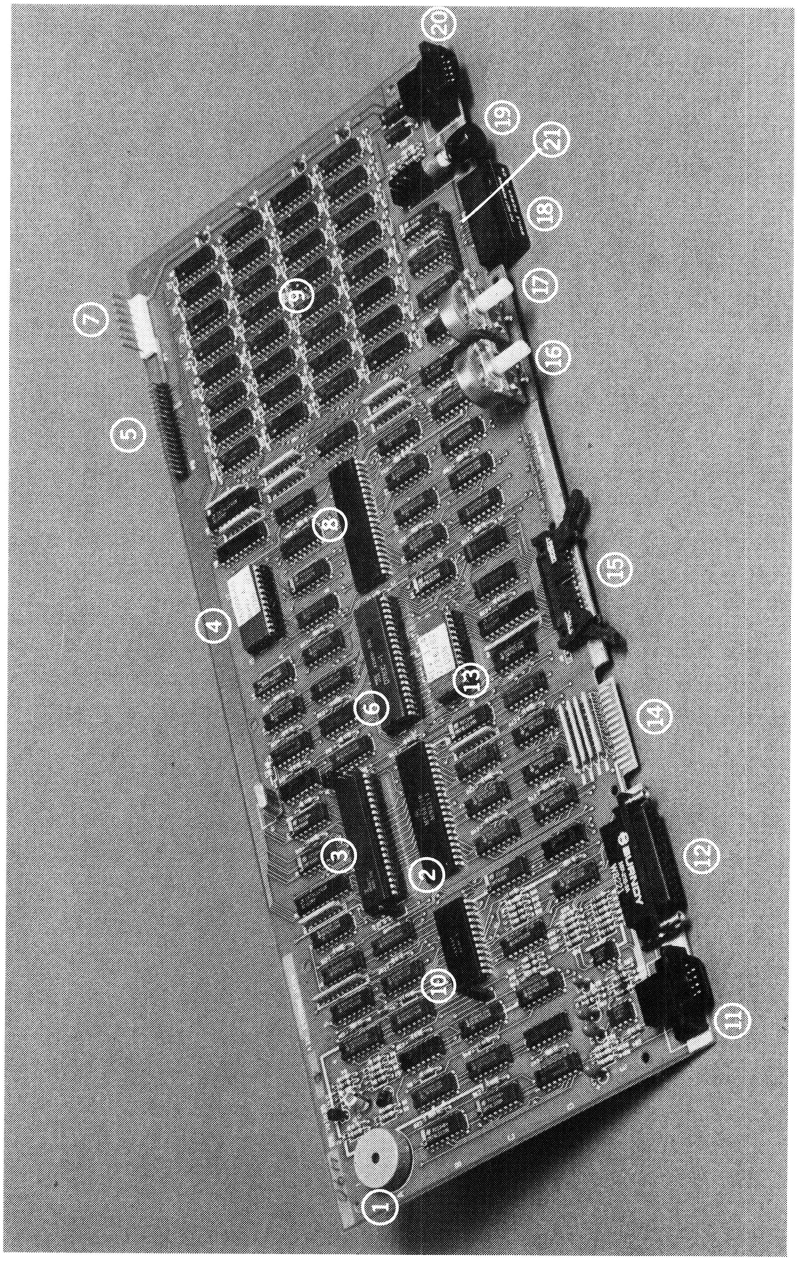
At the heart of the Osborne 1 computer lies the Zilog Z80A CPU. The 8-bit Z80A is a relative of the Intel 8080, which is the basis for the CP/M operating system.

The CPU is the primary source of "intelligence" for a computer and controls the flow of information in the computer system. The CPU and another component, the arithmetic logic unit (**ALU**), reside at the core of every computer system.



Above, the Z80 CPU of the Osborne 1 computer. Surrounding the integrated circuit is the actual silicon Z80 chip. Below, the various sections of the Z80 chip. (Photos courtesy of Zilog Corporation.)

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Key to System Board

1. Beeper
2. 6821 (for IEEE port)
3. Z80 CPU
4. Character generator
5. To floppy disk drives
6. Floppy disk controller
7. Power connector
8. 6821 (for keyboard port)
9. RAM
10. 6850 (for RS-232 port)
11. Modem
12. RS-232 port
13. System ROM
14. IEEE-488 port
15. Keyboard connector
16. Brightness control
17. Contrast control
18. External video (shunt on)
19. Reset button
20. Battery
21. Internal video monitor connector

In microprocessors such as the Z80, the ALU and CPU are combined into one integrated circuit. This integration is one of the differences between microcomputers and mini- and mainframe computers.

Most computers "think" in bits. A **bit** is a binary digit, the basic building block of information inside a computer. The most common grouping of binary digits, eight, is called a **byte.** A byte is the number of bits needed to express a single character. To store the 66 characters, including spaces and punctuation, in the previous sentence would require 66 bytes.

The 8-bit microprocessors have two common characteristics: 8 different lines that transport data to and from the CPU, and 16 different **address** lines that select memory location. Each line, called a **bus line,** carries one bit. The 8 bus lines carry bytes of information one at a time from memory to the CPU. The 16 address lines permit 65,536 (2 to the 16th power) memory locations, commonly referred to as 64K since **K** represents 1,024 (2 to the 10th power) memory locations.

Internal operations in a computer usually involve groups of bytes; 2 bytes is the most common unit. The computer must transfer 2 or more consecutive bytes of information to, or from, the RAM memory.

Inside the CPU are temporary locations for information, called **registers.** The number of registers has a direct bearing on the CPU's operation. Transferring information between the computer's memory and the CPU takes longer than transferring information within the CPU. With more registers, performance can be increased because more information can be processed within the CPU. Thus, the Z80, which has 12 more registers than the Intel 8080, is technically superior.

The System Clock

A **system clock,** a timing signal that coordinates the transfer of information in the computer system, also determines computer performance. Found in every computer, the system clock should not be confused with a **real-time clock,** which tells the time and date in the "real world." Faster system clocks make the CPU operate at

higher speeds so that the computer system can process more information.

The Osborne 1 computer uses a system clock of 4 **MHz** (megahertz, or 4 million cycles per second), the highest speed possible for the Z80A (the A representing the 4 MHz version). When coordinated with the proper circuitry, a 4 MHz Z80 performs at .57 **MIPS** (million instructions per second). With such a system clock, the Osborne 1's CPU more than adequately handles the control and computative needs of the computer.

The RAM

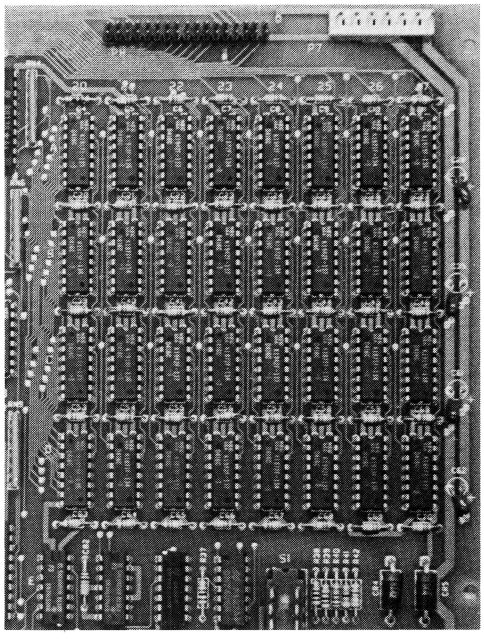
A second gauge of computer power is the RAM memory. Random access memory is the volatile user memory inside the computer system. RAM temporarily holds the programs and generated data processed by the computer system. Most of the computer's work involves RAM memory.

The larger the RAM, the larger the task the computer can do. The largest amount of memory directly addressable at one time by the Z80 CPU, and all 8-bit CPUs, is 64K. The maximum memory used by most CP/M-based application programs, such as accounting, word processing, and planning, is also 64K. For this reason, 64K of memory is provided with the standard Osborne 1.

Supplying a microcomputer system with 64K of memory has become popular because it is sufficient for most microcomputing tasks. A RAM of 64K is more than adequate for a portable computer and adds to the value of the Osborne 1.

It should be noted that the entire 64K of RAM is not available for most programs. The top 4K of RAM is devoted to the video display. This arrangement is explained in detail later in the chapter. Although 64K of RAM is provided in the Osborne 1, only 60K is available for user's programs. The loss, however, of 4K of programming space has minimal impact on the usability of the Osborne 1.

The RAM memory is organized into 4 rows of 8 **bits,** or integrated circuits. Each chip holds 16**K bits** (16,384 bits). A row of 8 chips forms 16K bits by 8 bits, or 16K **bytes.** Four rows of 16K yield 64K.



A closeup of the RAM memory circuits used in the Osborne 1 computer.

The RAM chips, which are soldered to the upper right side of the system board, are not easily accessible to the user because the user is not expected to service these parts.

Additional RAM memory is supplied to be used for video attributes (full- or half-intensity, etc.). This memory is provided by a single 4K-by-1 bit chip and is accessible to some programs, but is not used for programming and data storage. The organization of the Osborne 1's memory is discussed further after the following section on the ROM memory.

The ROM

RAM is the workspace every computer needs to hold temporarily the user's programs and information. A fully functional computing system also needs **ROM** (read-only memory). ROM supplies fun-

damental programs when the system is turned on. These programs, called **monitors,** provide intelligence to the computer.

Depending on the system board revision, the Osborne 1 computer contains one or two ROMs. The two types are 2716 (a 2K bits by 8 bits, or 2K bytes) and 2732 (4K bits by 8 bits, or 4K bytes). The system board contains two 2716 ROMs or one 2732; either set totals 4K of ROM memory.

The programs in the ROM are divided into two sets. The first set controls the flow of information between the computer and the video display, the keyboard, the parallel port, and the disk drives. The second set starts the floppy diskette loading the operating system, a process called **bootstrapping,** or booting the disk.

The set of programs that controls the flow of information from the computer's CPU and RAM memory to other devices is called the **RIOS** or ROM **BIOS,** an acronym for Basic Input/Output System. The CP/M operating system builds on the routines in the ROM BIOS to manage the computer's resources.

The ROMs reside at the base of memory, starting at location 0 in the second bank of memory. The Osborne 1's memory map and its use in the computer system are discussed in the next section of this chapter.

Originally, built-in diagnostic ROMs were used in the Osborne 1. These programs contained a self-test for the Osborne 1 that could pinpoint potential trouble prior to use. The tests were activated by typing a sequence of control characters on the keyboard when the computer was first turned on or later reset. The self-test and a real-time clock are no longer included. The ROM space occupied by these programs is used now for additional RIOS routines. Any diagnostic programs and clock routines can be executed from RAM memory.

The Osborne 1 Memory Map

The Osborne 1 computer has a unique method of communication between the CPU and various devices. The foundations for this method, called **bank switched memory** and **memory-mapped I/O**, stem from the Z80 CPU.

An 8-bit processor typically has 16 address lines and can directly use 2 to the 16th, or 65,536 (64K), different memory locations. This limit is typical of 8-bit CPUs. The memory addressed by the CPU may be RAM, ROM, or a combination of both. With additional circuitry, portions of the memory or a complete 64K section of memory may be selected. Each section is called a **bank.** When the circuitry selects a bank for the CPU to work with, the other banks of memory become invisible to the CPU. When additional space is needed, the circuitry selects another bank of memory, and the previously used section becomes invisible to the computer. This method lets 8-bit processors, such as the Z80, use more than 64K of memory.

The CPU can communicate to other devices in two ways. Traditionally, CPUs like the Z80 have used special channels on the chip that are called **ports.** The Z80 has 256 ports for communications between the CPU and peripherals. Since most peripherals need between 8 and 12 ports, the CPU can talk to as many as 32 devices. These ports are capable of bidirectional communications using the machine-language **IN** (read data from a port) and **OUT** (write data to a port) instructions.

The second method, memory-mapped I/O, reads and writes information into special memory locations. The CPU performs the input and output to various peripheral devices through these special memory locations. **Support chips** (integrated circuits to aid the CPU in communications), using this memory-mapped technique, are included in the design of the Osborne 1.

One disadvantage of memory-map input and output is that precious memory locations are used. As a result, the usable RAM space that provides the horsepower for computing systems is decreased. In 8-bit processors, memory-mapped I/O can seriously reduce the 64K RAM workspace.

The Osborne 1 skirts this problem by placing support chips for communications, the system ROM, and RAM in three banks of memory labeled 1, 2, and 3. Out of the 64K of RAM memory contained in the first bank, the top 4K is reserved for the video display's use. The next 8 1/4K of memory is taken by the CP/M operating system. The remainder of the RAM memory, except for a small portion at the bottom, is reserved for the user's programs and data.

The second bank has 64K; however, the top 3/4 of the first bank is shared with the second. Thus, all memory locations above 4,000H (hexadecimal, base 16, a popular numeric base for computers), or 16,384, are the same for both banks.

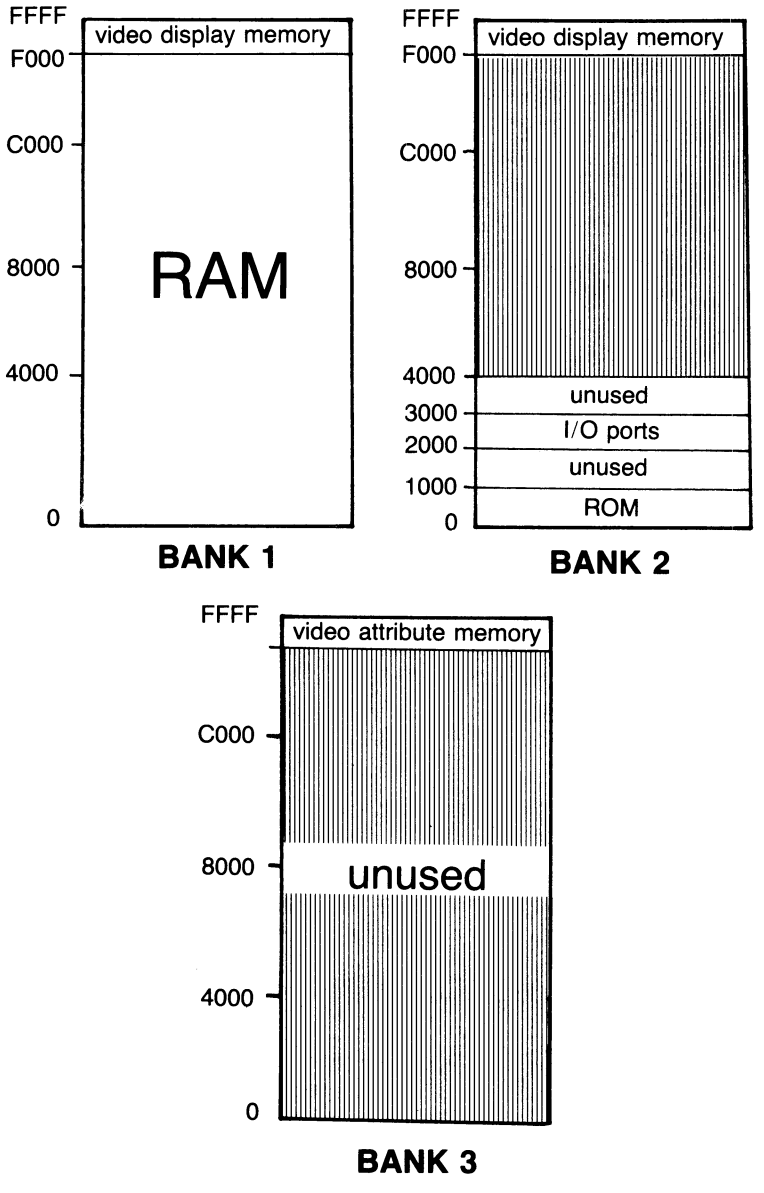
The difference between the two banks occurs in the lower 1/4 of memory. This 16K of the computer is divided into four separate 4K areas. The ROM of the Osborne 1 occupies the first 4K of the second bank of memory. The second and fourth 4K areas are unused, and the third is for the memory-mapped I/O performed by the computer system.

Bank 3 as well has 64K of memory; 4k by 1 bit of RAM memory resides at the top of this bank. This memory is used for normal or half-intensity video display. Each character on the Osborne 1's display (128 columns by 32 lines, but only 52 characters by 24 lines are visible at any one time) uses 1 bit of this memory. If the corresponding memory bit is 0, the character is displayed in half-intensity (light gray) video. If the corresponding memory bit is 1, the character is displayed in normal intensity (bright white). All remaining memory locations are unused in bank 3.

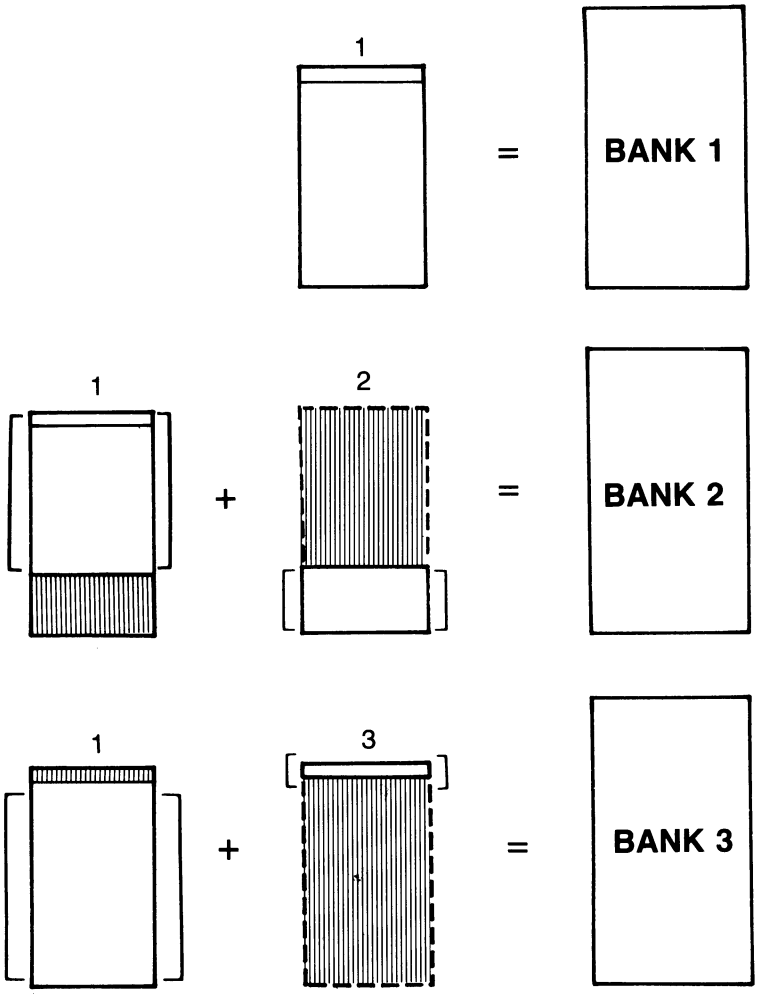
To select the second or third bank of memory, the user must write a small machine-language program that disables the interrupts of the computer system, performs an OUT instruction to a specific port (enabling the bank to select circuitry), and writes a zero into a special memory location. The reverse of this process enables the user to reselect the first bank of memory.

The Osborne 1's bank-switched memory differs from other computer systems in that the top 48K of memory is shared by the first and second banks. When the second bank is selected, the first 16K of RAM in the first bank becomes invisible to the CPU and inaccessible to the user's program. Thus, machine-language programs performing bank selection must operate above the 16K point.

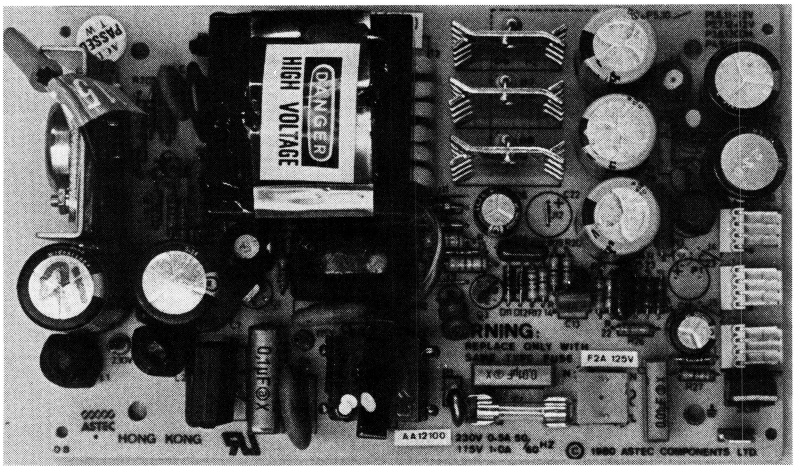
Bank-selected memory and memory-mapped I/O are discussed further in the sections on the CP/M operating system and the Osborne 1's peripherals.



The Osborne 1 computer uses three 64K banks of memory. Bank 1, used by programs, Bank 2, which contains the system ROM and Input/Output ports, and Bank 3, used for the video display attributes (inverse or normal video) are shown above.

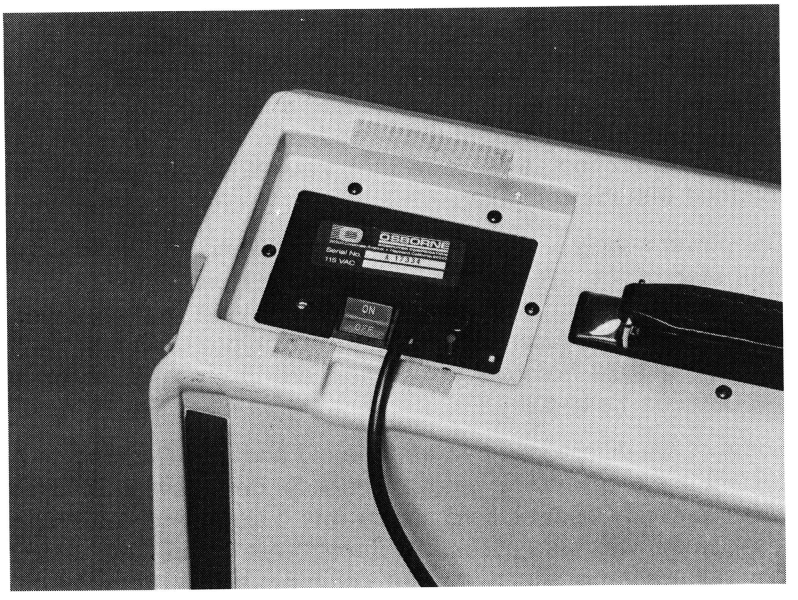


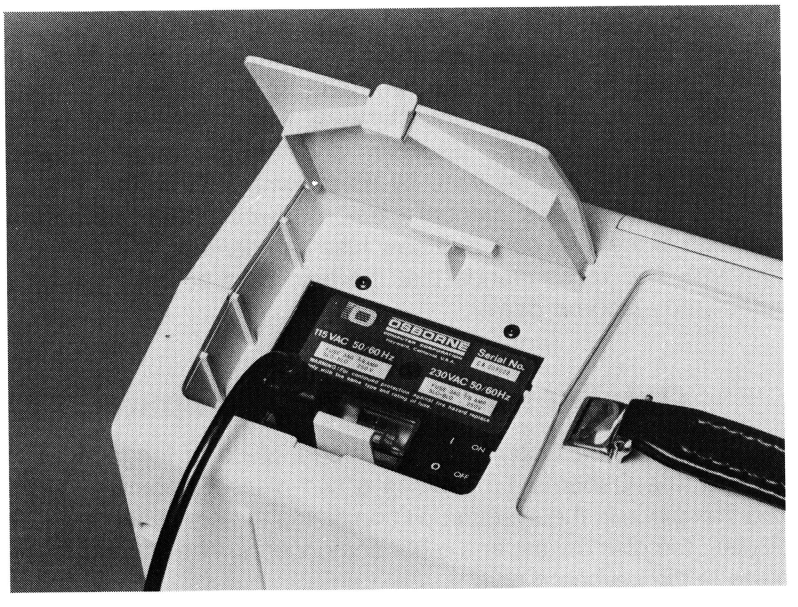
The shaded areas show the section of each bank that becomes invisible to the computer. In most programs, only Bank 1 is used. When programs directly address the I/O ports or use the system ROM, the upper 3/4 of Bank 1 (shown with the double line) is used with the lower 1/4 of Bank 2. The rest of Banks 1 and 2 (shaded areas) is invisible. When the program directly addresses the video attributes, the top 4K of Bank 3 is used with the rest of Bank 1's memory.



The Osborne power supply transforms the 110-240 volts AC into the necessary DC current for the computer.

Facing page, the power well of the older units (top) used a detachable cover, integral power cord, and a circuit breaker. The current units (bottom) use a hinged cover, removable power cord, a fuse rather than a circuit breaker, and a fuse card for overseas computer use.


OSBORNE
Serial No.
115 VAC
ON


OSBORNE
115 VAC 50/60 Hz
Serial No.
230 VAC 50/60 Hz
I ON
O OFF

The Power Supply

The final item of importance inside the Osborne 1 computer is the power supply. It transforms the alternating current (AC) from a wall outlet into the direct current (DC) needed by the Osborne 1's components. A six-foot, three-wire (hot, neutral, and ground) cord is provided with the computer.

The power supply weighs only 1 1/2 pounds and is mounted at the right rear of the system. The power supply uses high-efficiency switching technology that lowers 110 or 220 volts to the required 5 and 12 volts. Two fuses, one mounted on the power supply and the other accessible from the power well, are incorporated to protect the Osborne 1's circuitry.

Some of the differences between the old and new Osborne 1s are evident in the new power design. The older units have a removable hatch to the AC power cord, which was built-in. A circuit breaker reset button was also accessible through this hatch. The hatch on the new system is attached to the computer and is not removable. The power cord is not built-in, but plugs into a receptacle. Also, a fuse is used instead of the circuit breaker.

Another benefit of the new power supply is its ability to accept four different voltages. A **fuse card** can be removed, rotated, and reinstalled to accommodate 100, 120, 220, or 240 volts AC. As supplied by the manufacturer, the Osborne 1 uses the setting for 120 volts. The rotation of the fuse card and the installation of a new, appropriate fuse can be done by most owners. However, the supplement to the user's manual cautions owners that improper installation of the fuse card and new fuse can damage the Osborne 1 computer and recommends that the fuse card be changed by an authorized Osborne dealer.

Outside the Osborne 1 Computer

When closed, the Osborne 1 is a single piece of luggage. When opened, the Osborne 1 becomes a two-piece computing system. The first piece is the system unit containing the computer, the video display, the disk drives, and other components. The second smaller piece is the keyboard unit.

The Keyboard

The detachable one-piece unit is connected to a plug under the video display of the system unit by a cable that has been improved for the newer Osborne 1s. As indicated earlier, the older units' flat, ribbon connector, shielded by a copper braid, is less manageable than the coiled, rubber-encased cable on the newer units.

Full-Travel Technology

The keyboard is custom designed for Osborne Computer Corporation, and the principal supplier is Oak Switch Systems, Inc., in Crystal Lake, Illinois. The keyboard and keypad use "full travel membrane" (FTM) technology. Full travel means that the keys feel like typewriter keys. The membrane refers to the sealed electrical contacts on the keyboard's circuit board. The basic advantages of membrane keyboards are low cost, long life (rated at 100 million

The Osborne keyboard.

depressions per key), and protection. Dirt, dust, and spilled liquids do not affect the keyboard's operation because the contacts are in a sealed pad. This low-cost, rugged, full-travel membrane keyboard exemplifies the interest of the Osborne Computer Corporation in portability and low price.

The Overall Design

The keyboard is divided into two areas: a 57-key, upper- and lower-case QWERTY keyboard in the center of the detached unit; and a 12-key numeric keypad at the right of the keyboard.

Named after the letters in the upper left-hand row, the QWERTY keyboard has additional computer keys, such as the escape (ESC), shift (SHIFT), supershift (control or CTRL), and cursor-position keys (up, down, left, or right). The keypad contains the digits 0 through 9, a period, and an enter (RETURN) key that functions like the keyboard's carriage return.

Special-Function Keys

One feature of the Osborne 1 is the use of the number keys as programmable special-function keys. A special-function key is a key that can type one or several characters with one keystroke. Each of the numeric keys may be programmed through the SETUP program to "type" a series of characters. This capability makes operation easier by having one keystroke replace many typed characters.

The most popular use of special-function keys is with WordStar or SuperCalc. Each of the ten keys may be programmed to type the series of control characters used for cursor movement, document or spreadsheet recall and storage, paragraph reforming, or recalculation. The keys may also be programmed with CP/M commands like DIR or STAT.

On the Osborne 1 the total number of characters that may be programmed for all special-function keys is 96, including any control characters like the carriage return. If the double-density disk option has been installed, the total number is only 76. To use a special-function key after it is programmed, the operator simply depresses the control key and presses one of the numeric keys. The computer then "types" whatever is programmed into the special-function key.

Cursor-Control Keys

The cursor-control keys to the right of the keyboard are also programmable. The operator, through the SETUP program, may choose to use CP/M or WordStar with the cursor keys. The reason is that CP/M and WordStar expect two different sets of characters for moving the cursor. Regardless of whether the CP/M or WordStar mode is selected, the cursor-control keys, together with the control key, also govern scrolling of the video screen.

In summary, the Osborne 1's keyboard is both rugged and flexible: rugged through the use of the full travel membrane keyboard; and flexible through the ten programmable, special-function keys and the three different uses of the cursor-control keys (CP/M, WordStar, and video display scrolling in conjunction with the control key).

The Video Display

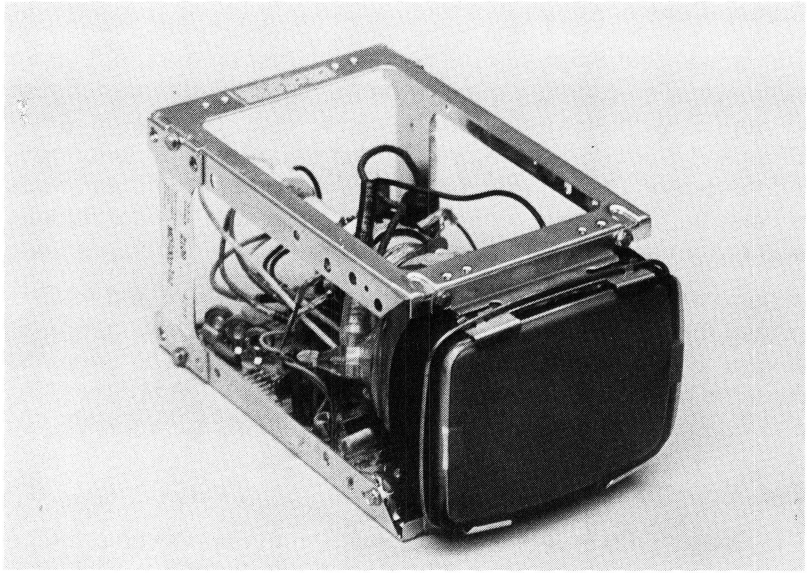
The Osborne 1's built-in video display is in the upper center of the front panel. This monochrome black-and-white display, which is 5 inches (125 mm.) diagonally, is one of the smallest offered with microcomputers today. Nevertheless, 52 characters on 24 lines can be displayed at one time.

General Characteristics

Beneath the screen are control knobs to adjust the brightness (BRT) and contrast (CONTR). With these controls, which function like those on an ordinary television set, the display can be viewed easily under most lighting conditions. The screen is difficult to read in direct sunlight, but shows up well in bright office light. Improper adjustment of the controls for short periods does not damage the display; however, characters become less legible, and curved lines (retrace lines) cross the screen.

Typically, a monitor is the single largest power-consuming device in a microcomputer. A larger monitor would need a larger internal power supply. The use of a 5-inch screen keeps low the weight, size, and price of the Osborne 1 and reduces the bulk and weight of the battery pack option.

On some systems, the video screen sometimes jumps and shrinks during disk operations. This minor annoyance is caused by the



The monitor assembly of the Osborne 1's internal 5-inch video display.

screen's closeness to the disk drives and a somewhat weakened power supply. The problem, however, causes no apparent harm to the Osborne 1's circuitry, disk drives, or video display.

Screen Characters

Although the display is small, its pica-sized characters are legible. One reason for their legibility is that characters with lower case descenders, like "y" or "p," drop below the line. Without descenders, "p" or "y" would rise too far above the line and decrease legibility. In addition, the lower case "m" appears as a reduced upper case "M," making that character easier to read on the small display.

Characters are displayed on the monitor in either a bright white or a light gray, *half-intensity* video. Many programs, including WordStar, use *half-intensity* characters to highlight menu selections or call attention to needed operator response. Characters may also be underlined.

Another set of characters, other than letters, numbers, and punctuation, are **graphic characters.** They are not found on the keyboard, but are activated when a certain sequence of characters is printed on the screen. The 32 special characters can be used by holding down the control (ESC) key and striking the second character. Graphic characters enhance educational and entertainment programs, but only a few of these programs are available to the CP/M system.

The **cursor,** which shows the location of the next character on the display, is a non-blinking underline character. The cursor's small size can make it difficult to locate on a screen full of characters.

Control Codes

The Osborne 1 can use a subset of the TeleVideo 912C/920C terminals' control codes, which are sequences of characters that, when printed, cause a certain action on the video display. Some of the control codes' functions are to activate half-intensity video or graphics characters, underline characters, erase the line where the cursor is located, move the cursor to the upper-left screen (home cursor), and erase all characters from the cursor to the beginning or end of the line. Most terminals use different control codes. Programmers, especially in word processing and spreadsheeting, must be knowledgeable about this unique set of control codes.

Two popular terminals are the TeleVideo 912C and 920C. Programs needing screen control can be customized with the TeleVideo 912C/920C's supplied installation programs. The video screen on the Osborne 1 can emulate the TeleVideo control codes so that programs can be customized easily for the Osborne 1. Thus, many CP/M programs not supplied with the Osborne 1 can be used successfully.

Screen Scrolling

The Osborne 1's nonstandard number of characters in a line, 52, has been criticized. The Osborne 1 solves this problem by scrolling the entire screen up, down, left, or right so that the viewer may read an area of up to 128 columns by 32 lines. Although only 52 characters by 24 lines are visible, programs "logically" believe the display is much larger. Movement of the screen is controlled by using the control key and the four cursor-position keys. Scrolling allows pro-

grams that require an 80 x 24 display to run on the Osborne 1 without modification.

Independent studies have stated that a 64-character line is the minimum needed for effective use. For word processing and spreadsheeting, 80 columns are helpful, and 128 columns are preferred. However, in view of the limits imposed by the production of a portable and cost-effective unit, the 52-column display, aided by vertical and horizontal scrolling, is acceptable in most cases.

The first WordStar program offered with the Osborne 1 allowed the user to scroll the screen from column 1 to column 128. The current program generally breaks the line and wraps the display to the next line when column 79 is reached. The *Osborne 1 User's Reference Guide* and the first issue of *Portable Companion* show how to change the current version of WordStar back to the original.

The spreadsheet program, SuperCalc, does not require screen scrolling. Sorcim modified the program for the Osborne 1's 52-column screen. Six 8-character columns are displayed instead of the typical nine 8-character columns on an 80-column screen. MicroSoft BASIC-80 and Digital Research's CBASIC use the entire 128-column "logical" (apparent) width of the video screen.

The native Osborne 1's limited width does not hinder the mobile operation of the video display. With half-intensity video and graphic characters, the system can use entertainment and educational software. The 52-column width, although awkward for some word processing or spreadsheet uses, still renders effective personal computing power. With the TeleVideo 912C/920C control codes and vertical or horizontal scrolling, most software packages can run on the Osborne 1 with little modification.

The 52/80/104-Column Option

In late 1982, the Osborne Computer Corporation officially announced an 80-column option for the Osborne 1 computer. This section presents details that were available at the time of this writing.

OCC promised to surprise the computer industry with an improvement in the video display. As announced, the 80-column option gives the Osborne 1 computer owner the ability to display either 52

or 80 characters on a line. The company kept its word. In addition to displaying the native 52 columns or 80 columns, the improved video can also display 104-column lines. Hence, the 80-column option is actually an 80/104-column upgrade.

Called SCREEN PAC™, the upgrade consists of a small circuit board that is mounted onto the Osborne 1 system board and a new video shunt. The primary purpose of the board is to alter the video timing signals. Once the circuit board is installed, either the internal video screen or an external video monitor can display any one of the three modes: native 52 column, 80 column, or 104 column.

When the mode is either 80 or 104 column, the size of each character is decreased to accommodate the additional characters on a line. The **resolution,** the number of dots used to form a character, is unchanged. Although character size is reduced, OCC states that the characters are sharp and legible in the 80- and 104-column modes. The Osborne 1's built-in monitor has sufficient video bandwidth and resolution to display 104 characters on a line.

The 80-column video option does not change the method to scroll the video display. The control key, in conjunction with the four cursor-control keys, moves the screen's display horizontally and vertically.

The display mode, whether 52, 80, or 104, is determined by a new version of the SETUP program provided with the video upgrade. With the new SETUP program, the operator selects one of the three modes and records this information either onto the diskette or into the computer's memory. When the diskette is booted, the Osborne 1's display indicates the chosen character-width mode. The only way to change the mode, once it is selected and entered, is to rerun the SETUP program or reboot the system with a diskette that has been configured for the other desired mode. The SETUP program is further discussed in Chapter 4.

Included with the SCREEN-PAC is a new video shunt that provides a **composite video** signal through an RCA™ phono connector on the shunt. No other adapter is needed for a standard video monitor. Owners of the Osborne monitor will be provided with a new adapter and cable for the SCREEN-PAC.

When the Osborne 1 is in the 80- or 104-column mode, few television sets equipped with an **RF modulator,** a device that converts the video signals of the Osborne 1 into standard broadcast channels, will legibly display the condensed characters. Even some monitors may not work satisfactorily with the 104-column mode. This subject is covered in the next chapter.

At the time of this writing, the Osborne Computer Corporation has not yet announced a policy for installing the SCREEN-PAC video upgrade. If it can be installed in the field, a dealer or an owner with technical know-how should be able to install the board. If a dealer does the installation, there may be a charge for labor and testing.

The SCREEN-PAC video upgrade overcomes one of the major objections to the portable Osborne 1: the limited number of characters on a line. OCC has pleasantly surprised both the microcomputer industry and Osborne 1 computer owners by extending the video display's capability to 104 characters on a line. This 80/104-column option enhances the value of the Osborne 1, which is already cost-effective.

The Disk Drives

The standard Osborne 1 has two mini-floppy disk drives to the left and right of the video display for permanent storage for the system.

Diskettes

Diskettes are available in two sizes: 8-inch and 5 1/4-inch. The larger, a floppy diskette, and the smaller, a mini-floppy, are inserted into a slot in a disk drive much as a video disk is placed in a video disk player. The novice might find discussions of diskettes confusing because computerists often interchange the term floppy disk with mini-floppy disk, and disk with diskette.

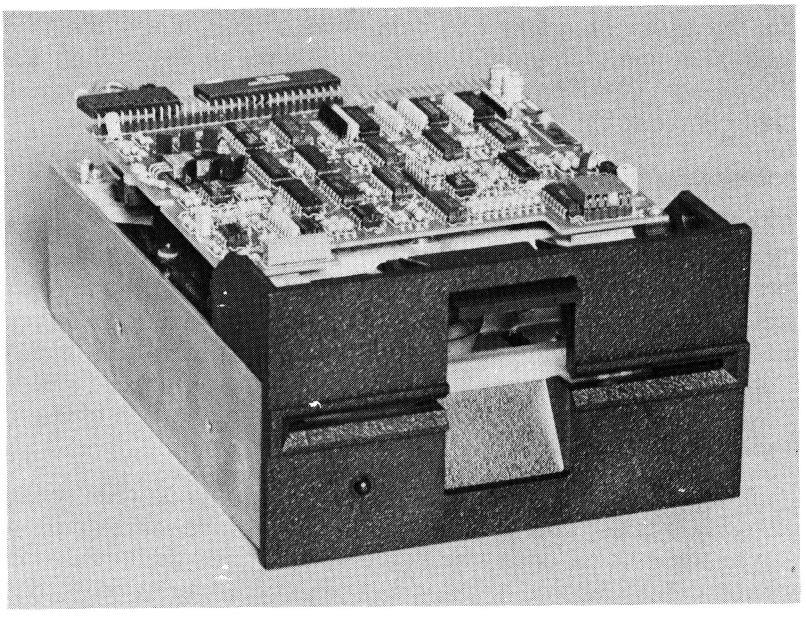
A diskette is a magnetically coated, circular piece of Mylar™ that is strengthened by a cardboard jacket. Cloth-like material is bound to the interior of the jacket to reduce friction and clean the diskette.

When placed into the diskette drive, the diskette revolves inside the jacket at approximately 300 r.p.m. (revolutions per minute). A ceramic recording head, or a set of two heads, similar to the head of a cassette tape player, writes (records) and reads (plays back) the

digital information recorded on the diskette. This head travels back and forth on an arm and makes contact with the diskette through the oval opening in the diskette's jacket.

Tracks. While the diskette spins inside the jacket, information is recorded on a series of concentric rings called tracks. The floppy disk drive determines the amount that can be recorded on a diskette, gauged by a track-per-inch (TPI) rating. The Osborne 1 computer uses a 48-TPI disk drive. Since the recording surface of a mini-floppy diskette is usually restricted to a 5/6-inch band, 40 tracks of information can be recorded on one side of a diskette.

A track near the outer edge of a diskette has a larger circumference than an inner track and, therefore, can hold more information. Additional instructions, which occupy more RAM memory, are required to handle this difference in circumference.



The mini-floppy disk drive of the Osborne 1.

Sectors. To simplify the operating system — the program that transfers information from the computer to the disk drives — each track is divided into equal slices, called **sectors.** Each track of the Osborne 1 computer's disk drive is divided into 10 sectors, and each sector holds 256 bytes of formatted data. Multiplying 40 tracks by the 10 sectors and the 256 bytes yields a total formatted storage capacity of 102,400 bytes, or 100K.

Actual Storage Capacity

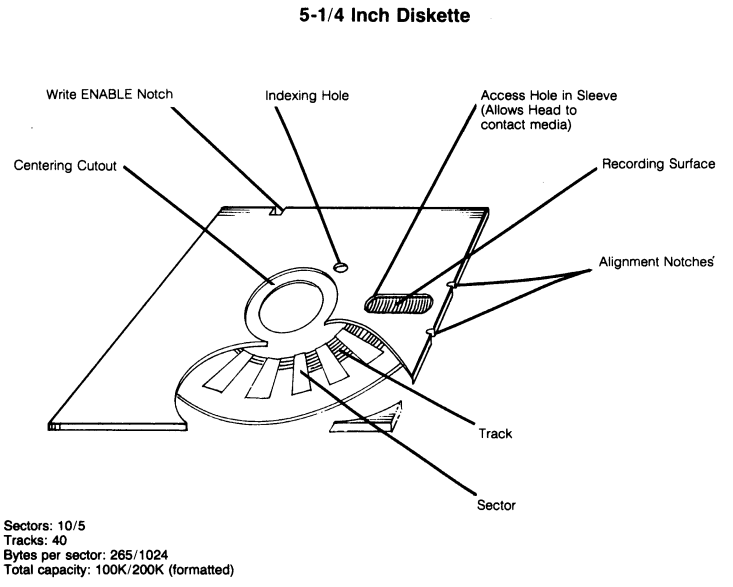
The actual space for the storage of programs and data is less, depending on the operating system. With the CP/M operating system, the first three tracks hold the operating system, and the fourth track contains the diskette's directory. With CP/M, the actual user storage capacity is 36 tracks by 10 sectors by 256 bytes for a total of 92,160 bytes, or 90K.

When computing disk capacity, all CP/M programs include the space devoted to the directory, although this space is not available for the user's programs and data storage. That is why the STAT and XDIR programs report 92K of disk space rather than 90K. Since most CP/M programs report disk storage in this fashion, the 92K convention is used throughout this discussion.

Increasing Storage Capacity

The storage capacity of floppy diskettes, both 8-inch and minifloppies, can be increased. There are three ways to increase disk storage capacity: using both sides of a diskette, doubling the number of tracks per inch, and doubling the density of the recording per sector. If all three methods were used on one diskette, a minifloppy diskette drive could hold as much as approximately 630K per drive. The Osborne 1, however, currently uses only one of the following three ways to increase diskette capacity.

1. **Double-Sided Diskettes.** One way to increase diskette storage capacity is to use both sides of a diskette in a drive with two recording heads, one for each side of the double-sided (abbreviated ds) diskette. The Osborne 1, like many other computer systems, uses **single-sided** (ss) storage; that is, only one side of the diskette is used for recording information. If disk drives for double-sided diskettes were used, the storage capacity could be doubled.



The anatomy of a floppy diskette. (Illustration by Dick Held.)

Double-sided drives are excellent for stationary computers, but are more fragile than single-sided drives and more vulnerable to shocks from traveling. Therefore, double-sided drives are not as appropriate for the Osborne 1 computer, which is designed as a portable system. When double-sided disk drives suitable for travel become commercially available, the Osborne 1 computer may use this method to increase floppy disk capacity.

2. **More Tracks per Inch.** A second way to increase storage capacity is to double the number of tracks recorded per inch of media surface. The drives that come with the Osborne 1 are formatted for 48 tracks per inch (TPI). Increasing the formatting to 96 TPI could double storage capacity. However, the alignment of the recording head in the disk drive is critical if 96-TPI drives are used. To avoid alignment difficulties, the Osborne 1 computer currently

uses only 48-TPI drives, whose alignment tolerance is far greater than that of the 96-TPI drives.

3. **The Double-Density Option.** Increasing the density of the disk recording is the third way to increase disk storage capacity, and the way that is used by the Osborne 1. A major option for the Osborne 1 computer is the double-density upgrade. This option, which is available for an additional $185 plus installation costs, doubles the disk storage of the native Osborne 1 computer, provides the ability to use diskettes formatted on select computers, and gives the Osborne 1 owner the UCSD p-System™.

The standard Osborne 1 records one "channel" of information per sector, which is called **single-density** (sd) formatting. As indicated earlier, the native Osborne 1 computer records 256 bytes per each disk sector. The Osborne 1 increases the amount of disk storage through a different recording scheme for the double-density (dd) disks. The double-density disks record five 1024-byte sectors rather than ten 256-byte sectors. The number of tracks per disk remains unchanged at 40. Multiplying the five sectors by the 1024 bytes by the 40 tracks yields 204,800 bytes or 200K. However, after CP/M extracts its necessary overhead, each diskette can hold only 180K. With 2 disk drives, the Osborne 1 can have double that capacity, or 360K.

The double-density upgrade consists of a new ROM for the computer, a slightly altered version of CP/M, and a new version of the SETUP and COPY utility programs. At present, the unit must be returned to the Osborne Computer Corporation for this upgrade. Although the disk drives are not replaced, each disk drive is tested to be certain that its alignment is correct. This procedure involves expensive test equipment that most Osborne dealers do not have.

After installation, the upgrade gives the Osborne 1 owner the ability to format and use single-density (92K) or double-density (180K) diskettes. When the new COPY utility is used, the program asks whether the diskette should be formatted in single-or double-density mode. The Osborne 1 automatically recognizes the density of an Osborne 1-formatted diskette when CP/M is booted or warm-booted (a subject covered in Chapter 4). With the double-density option, any mixture of single- or double-density diskettes may be

used. The only limitation is that the COPY program will not copy a single-sided diskette to a double-sided diskette, or vice versa.

The Transportability of Double-Density Diskettes

The single-sided, double-density mini-floppy is rapidly becoming an industry standard, which improves the possibility of running the same diskette on computers made by different manufacturers. Single-sided, double-density diskettes recorded on the Osborne 1 may be run on other computers with the *same 5 1/4" format, using CP/M.* For example, WordStar text files or SuperCalc data files created on the Osborne 1 can be transported to a different computer system and worked on. This transportability benefits not only companies owning different microcomputer systems, but also any Osborne 1 user.

A benefit of the double-density upgrade for the Osborne is that it can read and write mini-floppy diskettes formatted by other computer systems. Currently, the systems whose mini-floppy diskettes can be used by the Osborne 1 computer are listed as follows:

Xerox 820™ (single-density diskettes)

IBM Personal Computer (single-sided, CP/M-86 diskettes)

DEC VT-180

In addition, diskettes for the Radio Shack TRS-80, Models I and III, operating CP/M may be used with the Osborne computer. This capability requires modifying part of the Osborne's CP/M operating system and should be performed by a person knowledgeable about CP/M, assembly language programming, and the TRS-80 disk format under CP/M.

The Osborne 1's ability to read and write "foreign" diskettes is accomplished through changes to the Osborne's BIOS. A set of disk format tables is maintained in memory. These tables tell the Osborne computer how to handle the various foreign formats supported by Osborne Computer Corporation. When a different diskette is used in the system and CP/M is informed of the change, the computer attempts to read information from the diskette. If the format of the diskette matches one of the formats in the table, the Osborne adjusts to the new diskette.

This adaptability to different formats produces a minor disadvantage. The new version of the CP/M operating system uses 1/2K more than the old version. After installing the double-density option, the free space for programs and data is reduced by 1K. Therefore, an Osborne 1 using the double-density option has a CP/M system of 59K, not the previous 60K. The loss, however, of this 1K of RAM space will affect only a few programs.

It is important to note that the Osborne Computer Corporation does not provide a program to format on the Osborne 1, diskettes that will be compatible with other computer systems. The user must first format the diskettes on one of the other computer systems before the diskettes can be used with the Osborne computer.

A surprising benefit to purchasers of the double-density upgrade is the inclusion of the the UCSD p-System, which is a second operating system for the Osborne 1 computer. Covered further in Chapter 6 on the Osborne Software Library, the p-System is a universal operating system. The p-System currently runs on computers from the Apple II to the IBM Personal Computer, and even to Digital Equipment Corporation's PDP-11™ and LSI-11™ minicomputers. The beauty of the p-System is transportability. A program created on any p-System computer can be transported and operated without changing the program.

The entire p-System is not included with the double-density option. Only the run-time package is provided, which enables an Osborne 1 owner to use any precompiled p-System program. However, a p-System development package must be purchased to develop any program for the p-System. This package includes a programming language, usually the UCSD Pascal or FORTRAN language, and additional facilities for program development. If an Osborne owner is not interested in writing programs for the p-System, the run-time package is sufficient. It is another feature which demonstrates that the Osborne 1 is a value-based computer.

The Relation of Limited Storage to Application Programs

The Osborne 1's mini-floppy disk drives limit its storage capacity. The 92K held by a single-density drive, or even the 180K of a double-density drive, cannot compete with a mini-floppy disk drive that

holds 630K per diskette, or an 8-inch floppy that holds 1.2M (a million) bytes. This lower capacity is understandable, given the constraints of portability and price. Nevertheless, the Osborne 1's single-density disk drive can hold 30 pages of typewritten text, and the double-density disk drive can store approximately 60 pages. Such storage capacity seems adequate enough for many tasks.

For word-processing applications, either single- or double-density drives are sufficient. However, care should be taken when creating large manuscripts on the Osborne 1 with WordStar. WordStar can maintain three separate files for one text: the current file, a backup file of the last saved revision, and a temporary file created during the editing of a document that is deleted after each save. A document using 92K drives can be approximately 16 pages in length. The double-density drive can hold a document of approximately 32 pages per diskette. If this capacity is exceeded, WordStar may be unable to save the currently edited version. This latest version could then be lost.

The use of spelling checker/corrector programs on a single- density disk drive may be difficult. The spelling program's effectiveness depends on the size of its dictionary of correctly spelled words. These dictionaries require from 52K to 150K of diskette space, plus an additional 20K to 40K for the spelling programs. In some programs, the dictionaries fit on separate small-capacity, mini-floppy disk drives. Other programs have a smaller dictionary to accommodate the smaller drives. Both methods, however, decrease the spelling program's efficiency. If a spelling program is to be used, double-density drives are recommended.

For spreadsheeting, either disk drive is adequate, but the double-density disk drive has advantages. For example, it can store more SuperCalc models on the same diskette, thus reducing the number of needed diskettes. Also, housekeeping tasks are simplified for most applications (e.g., accounting, word processing, and education) when a diskette can store more data.

Some programs will not work with the Osborne 1's limited storage. Many accounting programs need high-capacity, 8-inch floppy disks or hard disk drives. However, small companies may find the Osborne 1 with the double-density disk option adequate for accounting.

Large data base programs demand large-capacity disk storage. Smaller files, such as those with names and addresses, sales history, and order information, can be stored successfully.

If the mini-floppy disk capacity is insufficient, there are available hard-disk units which provide from 5 to 20 megabytes of information, and operate much faster than floppy diskettes. Hard-disk units are suitable for an office environment, but cannot be used when portability is needed.

In summary, the mini-floppy disk capacity supplied with the Osborne 1 is sufficient for some personal computer uses, but the double-density option is recommended. Though the use of 8-inch floppies or hard disks contradicts the Osborne 1's design philosophy of portability and low price, such options are available, and the machine will function well with them.

Chapter 3
Connectors and Peripherals

Peripherals are devices that are not part of the CPU, RAM, or ROM circuitry, but are connected to the computer. Common peripherals are disk drives, printers, modems, and terminals. Video displays and keyboards sometimes fall under the category of peripherals; but since these two components are part of the standard Osborne 1 computer, they are not considered in this chapter. Instead, attention is given to external monitors and printers, and to the connectors by which peripherals are linked to the system.

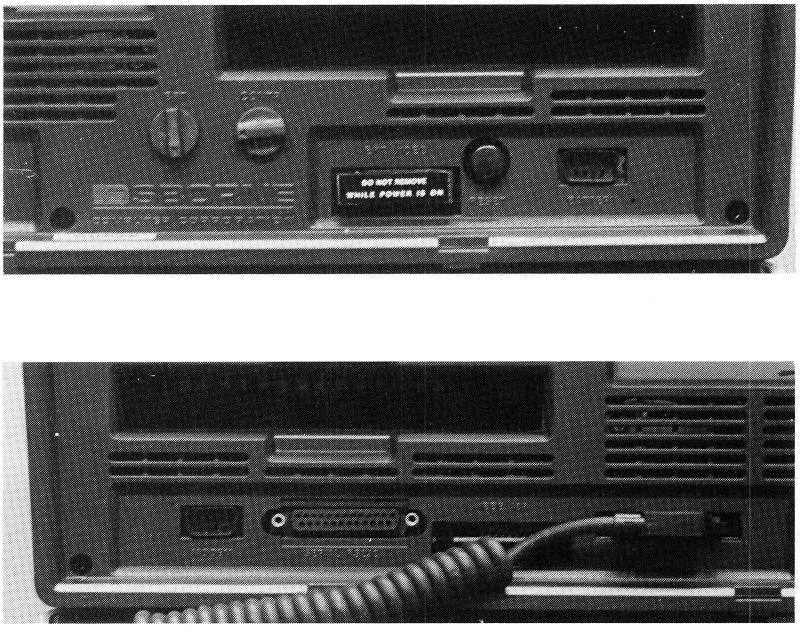
Connectors

One outstanding feature of the Osborne Computer is the ease with which peripherals can be attached to the system. The Osborne computer comes with both a parallel and a serial interface and their connectors. Many computer systems offer these interfaces as options, typically adding $50 to $300 to the price of the system.

The terms "connector," "interface," and "jack" are used frequently in this discussion. A **connector** is the plug that connects a cable to the computer or peripheral. The **interface** provides the proper electronic signals between the computer and the peripheral. A **jack** is a receptacle mounted on the computer or peripheral. A plug is inserted into a jack to make a pathway between the peripheral and the interface circuitry, which in the Osborne is part of the system board.

All the jacks on the Osborne are mounted on the front panel. These jacks are connected directly to the system board, with the exception of the jack for the battery pack. As the operator faces the Osborne and looks from left to right, the jacks are the modem jack; the RS-232 serial jack; the IEEE-488 instrumentation bus, which doubles as the "Centronics™" parallel connector; a keyboard jack, which should have a connector already attached to it; a jack for an external video monitor; and a jack for the battery pack.

The jacks are readily accessible when the Osborne is open, but protected when the case is closed. Designed to meet the general standards of the microcomputer industry, the jacks are compatible with most peripheral devices.



The six jacks and connectors for the Osborne computer.

Bus Systems

Most computers use a "bus." A **bus** is a common pathway for a computer's electronic signals. One popular bus is the S-100. It provides 100 bus lines for the computer's signals and power. Standardized as the IEEE-696 bus by the International Electric and Electronic Engineers Society, the S-100 bus has roots in the beginning of microcomputers and is used by many computer companies, such as Godbout, NorthStar, and Zenith.

Whereas the IEEE-696 bus offers compatibility with a variety of computer manufacturers, some companies offer their own bus structures. Apple Computer has a bus that provides seven slots for printed-circuit cards in the Apple II, and four slots in the Apple III™. IBM also offers its own bus for the IBM Personal Computer. In each case, the bus lines provide a common pathway for computer signals.

A complete S-100 bus system is constructed from three or four boards, each providing one or more functions. The first board contains the CPU, some ROM memory, and one or more serial or parallel interfaces for use with a terminal, printer, or some other peripheral. The second board holds the RAM memory, and the third board acts as the interface between the computer and the disk drives. In some cases, a fourth board is used to connect a hard disk drive to the system, or to provide additional peripheral interfaces.

Personal computers, such as the Apple or the IBM PC, have provisions on the system board for the CPU, RAM and ROM memory, and keyboard. However, for most peripherals, such as a printer or a disk drive, a card must be placed into one of the slots that are connected to the bus of the computer as pathways between the computer and the peripherals. Depending on a card's function or functions, it may sell for between $50 and $1900, with most single-purpose interface cards averaging $225 in price. These additional cards provide the necessary circuits for connecting the computer to the peripherals. For both the Apple II and the IBM Personal Computer, an appropriate card is required for a disk drive, modem, or printer. The IBM PC needs also an appropriate card for any video display; but the Apple II, which comes with a 40-column display, requires a special board only if 80-character lines are desired.

Unlike the S-100 systems, the Apple II, or the IBM Personal Computer, the Osborne 1 computer does not have a bus system, but utilizes the IEEE-488 jack, which has some of the signals normally provided by an extended bus system. Instead, the Osborne 1 has several common, built-in interfaces. Furthermore, unlike S-100 computers, the Osborne 1 contains the CPU, ROM and RAM memories, the keyboard, and the display; and unlike the Apple II or the IBM Personal Computer, two serial connections, one RS-232 port, one modem port, and a parallel port are provided with the system. The disk drives are also integral parts of the Osborne 1 computer. Thus, the most common interfaces and connections are incorporated into the basic unit, and most Osborne owners will find the provided interfaces and connections sufficient for their needs.

Jacks

The jacks on the front of the Osborne provide a pathway from the interface circuitry to the peripherals. As indicated earlier, there are six jacks on the computer. One, the keyboard jack, already has a connector attached to it and is not considered in the following discussion.

The Osborne Modem Jack

A **modem,** which is an abbreviation of **Mo**dulator-**Dem**odulator, is a device for connecting a computer to a telephone. A computer has digital circuitry, but a telephone uses analog circuitry. The telephone can transmit and receive audio signals, but cannot transmit digital signals (one's and zero's). If computer signals are to be sent over the telephone, they must first be transformed into audible tones. The modulator portion of the modem does this task, turning computer signals into audible sounds for transmission over telephone lines. When a computer is at the receiving end of a transmission, the demodulator portion of the modem changes audible tones into digital signals the computer can use.

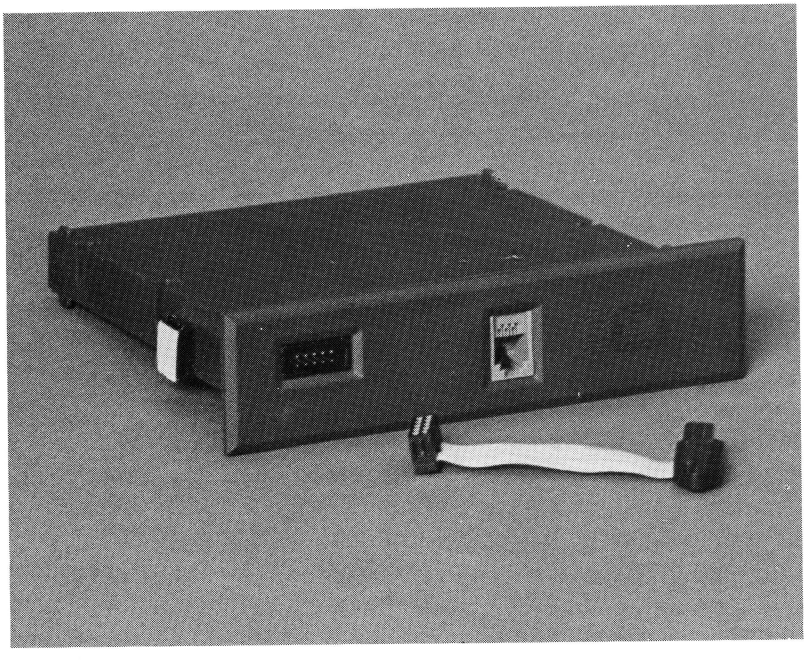
With a modem, computers can "talk" to other computers. The modem gives the personal computer owner access to information from across the world, from newspaper wire services, from stock market reports, and from local bank accounts.

One of OCC's first optional products was the modem. Called Comm-Pac™, the modem option included a 300-baud, direct-

connect, auto-dial, auto-answer modem, a cable to connect the modem to the Osborne 1, AMCALL communication software, a subscription to The Source, and a trial subscription to the Dow Jones News/Retrieval Service. The Source and the Dow Jones News/Retrieval Service are discussed in Chapter 7 on communications.

The Osborne modem mounts into the left diskette "pocket" of the Osborne 1. For the old Osborne 1 case, the modem simply slides into the pocket. In the new Osborne 1 case, the pocket is different in size, and eight small tabs projecting from the modem's plastic case have to be broken off before the modem is inserted into the pocket.

A small cable connects the modem to the modem port of the Osborne 1. The cable and connectors are made so that the cable



The Osborne modem.

cannot be installed incorrectly. After installation, the case can be closed so that the modem can be easily transported with the computer.

The modem is powered by the Osborne 1 computer. This arrangement permits the modem to be used while operating the computer with the Powr-Pac, the Osborne battery pack. The only additional item needed for communications is a cord equipped with an RJ-11C plug to connect the Osborne modem to the telephone's wall socket. This cord may be readily obtained at stores selling telephone equipment, such as hardware or electronics stores. The price is dependent on the length of the cord — usually, from 6 to 25 feet — and should be under $10.

As indicated earlier, the Osborne modem supports 300-baud speeds for communications. Most modems in this category also support the slower 110-baud (11 character-per-second rate). The 110-baud rate is almost obsolete and has been popularly replaced by the faster baud rates. The absence of the 110-baud rate on the Osborne modem is no disadvantage at all.

Several modems, and time-sharing systems, can support a faster, 1200-baud rate (120 characters per second). This rate is four times faster than the 300-baud rate, but the modems that support the faster speed are two to three times more expensive. These faster modems, such as the Hayes Smartmodem 1200™, are available; their retail price is in the $700 range. They can be used with the RS-232 serial jack of the Osborne 1 computer.

The Osborne modem is a direct-connect modem. This kind of modem is an improvement over its predecessor, the acoustically coupled modem, which, nevertheless, still has certain advantages. Acoustically coupled modems are portable and are not wired directly to the telephone, which is one advantage. The acoustic coupler is connected to the computer through a RS-232 serial interface. The telephone number of the host computer is dialed on a telephone. After the connection is made, the telephone handset is placed into the cups of the acoustic coupler, which then provides low-speed transmission of data, between 11 (110 baud) and 30 (300 baud) characters per second. Another advantage of the acoustic coupler is that it can be used with any standard telephone handset without

violating telephone companies' regulations against connecting foreign equipment to a telephone.

The advent of the modular telephone jack and certain judicial decisions have made the direct-connect modem popular. A direct- connect modem is what its name implies: a modem that is connected directly to the telephone's wall jack, bypassing the telephone.

Direct-connect modems have several benefits:

- Immunity from external audio noises
- Optimum signal-to-noise ratio
- High-speed transmission capability (in some models)
- Relative small size

Sales of direct-connect modems have increased dramatically in recent years because of a combination of factors: declining prices, ease of use (the Osborne 1 computer accepts a modem with ease), an increase in the number of personal computers with communications ability, and growth in the number of public data bases that can be accessed by a modem.

One feature of the Osborne 1 modem is the use of an automatic dialer. Modems with automatic dialers permit the modem itself to "pick up" the phone line and dial the appropriate phone number without intervention. Without the dialer, the computer's operator must dial the number, wait for the connection to be made, have the modem pick up the phone line, and replace the handset on the phone. With the dialer, the Osborne modem is easy to use for either the novice or experienced user.

The modem also uses pulse dialing, the method used by most rotary dial telephones. The pulse-dial method is the most common for "non-Bell" replacement phones because even Touch Tone™ phone lines will accept the pulse method of dialing.

A small disadvantage of pulse dialing is that it is slower than Touch-Tone-equipped modems and does not work with certain commercial switchboards. If the modem does not work with the phone system inside the building, the computer's operator must manually dial an outside line, then allow the modem to "pick up" the line and complete the call.

Most homes and offices in the United States and Canada use a modular RJ-11 jack for telephone connection. This jack is required for modem connection, and, if the current telephone does not have this type of connection, an RJ-11 jack must be installed.

The RS-232 Serial Jack

The second jack to be considered, the RS-232 serial jack, is the one used most frequently. In fact, the RS-232 standard is the most popular form of connection between computers and peripherals in the industry today.

The RS-232 jack allows the Osborne 1 to talk to:

- Letter-quality printers
- Dot-matrix printers
- Plotters
- Digitizers
- Telecommunications sources (via a modem)
- Other computers
- Speech synthesizers

The list of devices that use the RS-232 standard is long. The most common ones are modems, plotters, and printers.

The word "standard" may be misleading in connection with RS-232. RS-232 is actually a set of standards established by the Electronic Industries Association (EIA) to cover both physical connections and electronic requirements for communications. RS-232-C is widely used with microcomputers. However, there are 15 different line configurations, designated with a single letter suffix from A through M or Z. Two forms are commonly used for physical connections: C, mainly for one-way communications from computers to printers; and D, predominantly for two-way communications by modems and terminals.

The major problems with RS-232 arise in handshaking and line assignment.

Coordinating communications between two computers, or between a computer and its peripherals, is called **handshaking,** which is necessary for medium-to-high baud rates (from 1200 baud up).

The RS-232 Interface at a Glance

Purpose:	To provide asynchronous serial communications between the Osborne 1 computer and other devices, including printers, modems, plotters, and other computers
Location:	Lower left of front panel
Connector:	B-25F (25-pin female)
Speed:	Two sets of two speeds: 300/1200 baud or 600/2400 baud (Set of speeds is selectable by the jumper on the system board. Choice of speed software.) 1200 baud default
Characteristics:	1. Asynchronous communications only 2. Communications handled by BIOS 3. Memory-mapped 6850 ACIA 4. Data Terminal Equipment (DTE) configuration
Pin Out:	See below

Pin Number	Description	Logic Term	EIA Term	To Computer	From Computer
1	Frame Ground	GND	AA	—	—
2	Transmit Data	TX	BA		->
3	Receive Data	RX	BB	<-	
4	Request to Send	RTS	CA		->
5	Clear to Send	CTS	CB	<-	
6	Data Set Ready	DSR	CC	<-	
7	Signal Ground	SG	AB	—	—
8	Data Carrier Detect	DCD	CD	<-	
20	Data Terminal Ready	DTR	CD	->	

Handshaking can take place through either hardware or software. In hardware handshaking, one or more RS-232 lines indicate that a peripheral, such as a printer, is ready to accept more characters. Software handshaking uses special transmitted characters to coordinate the transfer of information.

Devices that use serial communications are divided into two groups: DCE and DTE. **DCE** is an abbreviation of Data Communications Equipment, and **DTE** is the abbreviation of Data Terminal Equipment. DTE devices are usually terminals, and DCE devices are usually modems. Only one device at a time may send

information down a wire. If two serial devices are connected, one must be a DTE type, and the other, a DCE type. If both were the same type, they would transmit data on the same line and receive information on the other line, making successful communication impossible.

The Osborne 1 is a DTE type of computer. It uses the second serial line to transmit data to a device, and the third line to receive data. The opposite must be true for the other device. It must use the second line to receive data, and the third line to transmit data. Many of the problems that arise when the Osborne 1 is connected to certain printers or other computers occur when both parties want to use line two for transmitting and line three for receiving. The solution to this problem is to reverse the two lines on one end of the cable that joins the Osborne 1 and the other device.

When purchasing an RS-232 peripheral, such as a printer, the buyer should consult with an Osborne dealer to be certain that the computer and the peripheral are compatible.

The SETUP program supplied by Osborne (covered in the next chapter) offers three different serial (RS-232) options for printers. These options cover most daisywheel and dot-matrix serial printers. However, only one of the three options is correct for any particular printer. Consultation with the printer's vendor should provide the information necessary for selecting the appropriate option.

When a serial device is connected to the Osborne 1, the CP/M operating system must be informed by either a SETUP or STAT program. Failure to inform CP/M properly about the nature and speed of the serial device can cause the computer to "lock-up." Lock-up can be remedied only by pressing the reset button, a measure that destroys any work in progress.

Some of the many peripherals that use RS-232 communications need a separately purchased program to work with the Osborne 1 computer. Before buying such a program, consult a dealer to find out whether it is necessary.

The device most used with the RS-232 jack is a printer, and the SETUP program allows three different protocols of computer/printer communications:

- X-ON,X-OFF
- ETX/ACK
- STANDARD SERIAL (MARK)

WordStar allows the use of many communication protocols that automatically take advantage of printer features commonly desired in word processors. Other programs need manual commands to use these features.

Some programs, called **printer utility programs,** are designed to mate other programs with a particular printer and are usually found as an option. A printer cannot function properly unless its special feature codes are chosen correctly by a utility program.

Peripherals can be easily connected to the RS-232 serial jack on the Osborne 1, particularly since almost all popular RS-232 protocols are included with the computer.

The IEEE-488 Jack

The IEEE-488 parallel connector provides a path for the use of intelligent peripherals. **Intelligent peripherals** have their own microprocessors — thus freeing up the Osborne 1's Z-80A for other activities — and include the following:

- Mass storage devices, such as hard disk drives and magnetic tape units
- Plotters for graphs
- Industrial control devices, such as robots
- Telephone hookups (modems)

The IEEE-488 jack on the Osborne 1 is slightly different from standard IEEE-488 connectors in that it uses an edge connection that protrudes from the system board and makes available 26 individual connections. This nonstandard connection was chosen because, with the appropriate connector, the port may be used for either the IEEE-488 standard or the Centronics parallel standard. This dual arrangement causes no problems, and the jack handles either task well.

To activate the IEEE-488 jack, the SETUP command (located on the CP/M master diskette) should be used. Either the IEEE-488 or the Centronics parallel printer option must be chosen when the SETUP program asks for a choice, or the CP/M IOBYTE must be changed. (The *Osborne 1 User's Reference Guide* fully demonstrates how to do this.) After this change is made, any IEEE-488 peripheral may be used. Successive diskettes must also have the same SETUP configuration.

The IEEE-488 method of communication is sometimes called GPIB (for General Purpose Input/Output Bus), Hewlett-Packard calls it an HPIB bus. By either name, the method is for attaching up to 16 different devices along a common bus. By definition, a bus is parallel, which means that the eight bits that form a byte are transmitted on eight separate lines in the connecting cable. The GPIB bus is used primarily with intelligent instruments and test equipment.

Devices connected to the GPIB bus are organized into "talkers" and "listeners." A **talker** transmits data down a bus; a **listener** receives the data. The reason for this division is simple: when there are up to 16 different devices on a common bus, the talkers and listeners make certain that no two devices compete for the bus at the same time. If they did, the data of the two devices sending simultaneously would be garbled. To avoid this problem, only one device at a time is allowed to send information on the bus.

To be IEEE-488 compatible, a device must have enough intelligence to know its device number. Devices on the GPIB bus are numbered 0 through 15. Usually, the computer assumes control of the bus and sends a special message to each device, making it either a talker or a listener. The special signal normally contains the number of the desired device. If it is intelligent, it will respond, whereas all other devices will ignore the data on the bus.

The GPIB method works well. Several companies, Such as Commodore Business Machines, Hewlett-Packard, and Tektronics, employ this method to connect computers and intelligent peripherals. Corvus uses the IEEE-488 bus to link its Winchester hard disk drives to the Osborne 1. Most modems, printers, plotters, test

equipment, and other equipment manufactured for the IEEE-488 bus should work with the Osborne 1 computer.

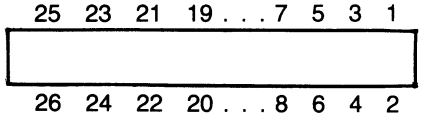
There is one physical, and one electronic, restriction in the use of the IEEE-488 bus on the Osborne 1 computer. The physical restriction is that an appropriate connector is needed to turn the Osborne 1's edge connection into the GPIB standard connector. The electronic restriction is that the Osborne 1 can use only one device on the IEEE-488 bus. The native Osborne communicates with device 0. A software patch to CP/M, available from Osborne dealers, can be used to alter the default device number. Osbornes equipped with the double-density upgrade can change the IEEE number by using the new SETUP program provided with the upgrade.

The "Centronics" parallel printer protocol can be used easily with the Osborne 1 if the correct option is selected in the SETUP program. However, an appropriate cable is needed to connect a "Centronics" type of printer to the Osborne 1's IEEE-488 jack.

The following is a table of the conversions between IEEE-488 standard pin signals and the Osborne 1's implementation:

IEEE-488	Osborne	Signal Name
1	1	DATA BIT 1
2	3	DATA BIT 2
3	5	DATA BIT 3
4	7	DATA BIT 4
5	9	END OR IDENTIFY
6	11	DATA VALID
7	13	NOT READY FOR DATA
8	15	NO DATA ACCEPTED
9	17	INTERFACE CLEAR
10	19	SERVICE REQUEST
11	21	ATTENTION
12	23	CABLE SHIELD, GROUND
13	2	DATA BIT 5
14	4	DATA BIT 6
15	6	DATA BIT 7
16	8	DATA BIT 8
17	10	REMOTE ENABLE
18-24	12,14,16, 18,20,22,24	SIGNAL GROUND

Pin Number Chart



IEEE-488 Command Chart

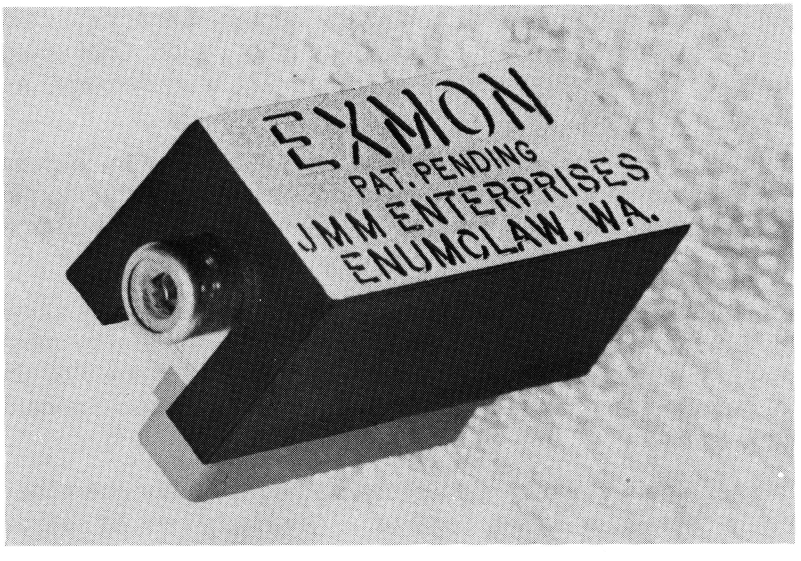
- Control Out
- Status In
- Goto Standby
- Take Control
- Output Interface Message
- Output Device Message
- Input Device Message
- Input Parallel Poll Message

The External Video Bus

The fourth peripheral jack, which is for an external video device, is located in the lower right of the Osborne 1's front panel. Normally, this jack is covered by a square black plug that sends video information generated by the computer to its internal screen. The video signals, however, can be sent through an adapting device to either an external monitor or a television adapter.

Many microcomputers need an external monitor for a video display (one of the extras that must be bought). Few computers that have a built-in screen can accommodate an external monitor, but the Osborne 1 computer has both a built-in screen and external video capabilities.

As indicated earlier, the signals from the external video jack cannot be used directly by a monitor or a television; they must first be adapted to composite (all information) video signals.



The EXMON is an adapter that connects a video monitor to the Osborne's external video connector. (Photo courtesy of JMM Enterprises.)

Without an adapter, any attempt to solder wires directly to the Osborne 1's video connector will result in a fuzzy picture and possible damage to the computer's video circuitry, power supply, or both. This kind of modification will also void the computer's warranty.

An owner who prefers to avoid the cost of a monitor by using instead a regular television set will need an RF modulator, which changes the composite video signals of the Osborne 1 into standard, television broadcasting signals. Several types of RF modulators are available. Most operate on channels 3 or 33, the latter providing less competition with most VCRs and video games, and less interference with most local television stations.

The black plug in the computer's external video jack is called a **video shunt.** Any device plugged into the external video jack will make contact with the bottom 10 connections, which are the live ones. The top 10 connections are for the built-in screen's circuitry.

The Osborne 1 should not be operated without the video shunt or a suitable adapter connected to the video port. Operating the computer without a suitable shunt or adapter can damage the video circuitry, the power supply, or both. Also, such a connector should never be removed while the computer's power is on. Unplugging the shunt or adapter during operation will also damage the Osborne's circuitry.

Currently, the same screen-size limitations (52/80/or 104 columns across) apply to any monitor or television that is hooked up to the external video bus, even though the external monitor can be scrolled.

Screen-Pac, the 80-/104-column upgrade, includes a new video shunt which provides a composite video signal suitable for most monitors. Therefore, Osborne owners purchasing Screen-Pac do not have to purchase a video adapter in order to use a standard video monitor.

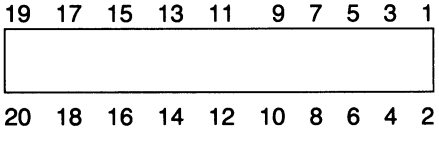
Television sets, however, usually cannot display 80-character lines legibly because of limited bandwidth. The display will be blurred and in some cases completely unreadable. Therefore, those who want to employ the 80-/104-column option should buy a video monitor and not use a television set.

EXTERNAL VIDEO CONNECTOR

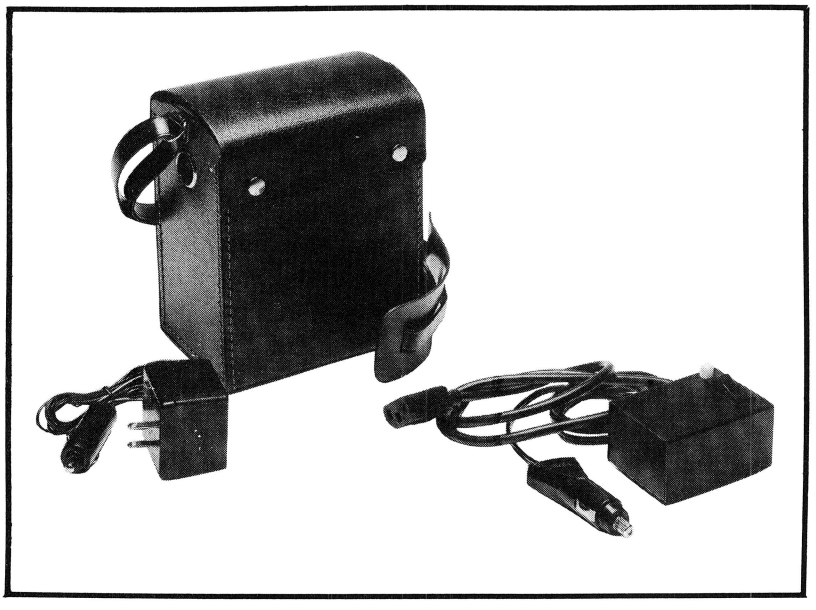
Pin out of video connector

Pin (bottom)	Pin (top)	Signal
2	1	Ground
4	3	Brightness High
6	5	Brightness Low
8	7	Brightness Arm
10	9	Ground
12	11	Horizontal Sync.
14	13	+12 VDC CRT
16	15	Video Out
18	17	Vertical Sync.
20	19	Ground

Pin Number Chart



All signals originate from the bottom (even-numbered) pins of the external video jack. The black video shunt connects each even-numbered pin on the edge connector to the appropriate odd-numbered pin that leads to the internal video monitor connector on the system board.



The POWR-PAC's rechargeable battery makes possible even greater portability by allowing use of the computer away from sources of electricity. (Photo courtesy of Osborne Computer Corporation.)

When purchasing a monitor, a prospective buyer should test the picture with an Osborne 1 computer before completing the purchase to be certain that the monitor functions satisfactorily with this computer.

The Battery Pack

One of the first options announced for the Osborne was the battery pack. With it, the Osborne 1 can be operated anywhere. The POWR-PAC™, the name of the battery pack, is a three-piece set. The major unit is the sealed lead, lead dioxide battery that provides one hour of power. The battery comes in a carrying case with a shoulder strap for easy transportation. The one-hour rating is based on using all parts of the Osborne continuously. Because the mini-floppy disk drives are not used constantly, the battery will provide power for periods greater than one hour. A warning buzzer in the

power pack signals when five minutes of power remain, giving ample time to save any files on the disk storage.

The second piece is the AC battery charger. This piece also fits into the battery pack's carrying case for convenience. The battery charger uses 110 volts AC at 60 Hz, which is wall-outlet voltage in the United States and Canada. The charger will fully recharge the battery in 16 hours. Less time is necessary if the battery is not fully discharged.

The third piece of the POWR-PAC is a DC power inverter, which allows the Osborne 1 to run from a 12-volt car battery. The inverter plugs into the car's cigarette lighter and into the 3-prong outlet in the Osborne 1's power well. The power inverter does not need the use of the battery pack. With the inverter, the Osborne 1 computer can be used in or near a car if the car battery is properly charged.

OCC will send an adapter to owners of older Osborne units (tan colored case) so that they can use the POWR-PAC with their units.

The battery pack and the DC inverter use the jack for a three-pronged plug located in the power well at the rear of the Osborne. The 9-pin "BATT" jack, located at the far right of the front panel of the Osborne 1, is for use with an external battery.

Only 4 of the 9 pins in the BATT jack are used. Pin 1 (upper left) carries the +5 voltage, and pin 5 (upper right) is for the +12 voltage. Pins 7 and 8 (center pins, lower row) are grounds. As with the modem and the RS-232 port, the battery pack's connector can be plugged into the Osborne 1 only one way, making it impossible to attach the connector incorrectly.

Peripherals

Three of the most commonly used peripherals are the external monitor, the disk drive, and the printer.

External Monitors

Although the Osborne 1 computer comes with a built-in screen that should be sufficient for most needs, some users will want to add an external monitor to the system. An external monitor, together with

the double-density disk upgrade, can overcome the character-size and line-width limitations of the built-in screen. As indicated earlier, the native computer does not allow direct connection to an external video monitor or television, but requires an adapter.

An external monitor is beneficial for educational and other applications where a number of people must view the screen simultaneously. The Osborne 1's built-in screen is too small for this kind of use, particularly since the screen is less legible when viewed at an angle.

A color monitor is not recommended for the Osborne 1 because it does not output color signals. However, a high resolution monitor may be necessary for the 104-column video mode. Owners of SCREEN-PAC™ will require a monitor with a bandwidth of 12 MHz (megahertz) to legibly display the 104-column lines. If the user does not plan to purchase the 80/104 column upgrade, the best purchase is a relatively inexpensive monochrome monitor.

A new owner should use the Osborne for several weeks before buying a monitor, unless there is an immediate reason to purchase one. The built-in 5" screen may at first seem too small, but after several hours of operation, the user should adjust to the size of the display and find that it is easily readable, even for long sessions with the computer.

Printers

The peripheral most Osborne 1 owners buy is a printer. Prices for printers vary widely, depending on their speed and quality, and a printer of fine quality can cost a great deal more than the Osborne 1 computer. For many Osborne 1 owners, the largest single outlay is for a printer.

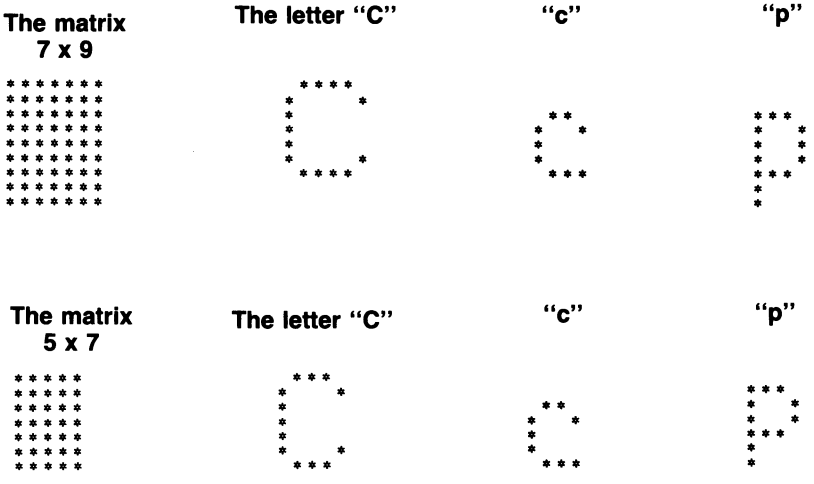
Printers are important and deserve much consideration. Few devices used with the Osborne 1 need more consideration. To aid those who are planning to buy a printer, the following section presents a general description of the types of printers and how they can be connected to the Osborne 1.

Printers are evolving as fast as microcomputers. The demand for printers has brought a reduction in their prices, but an increase in their features. Printers and their perceived qualities are almost as varied as the individuals who buy them. Generally, there are two types of printers used with personal computers: dot-matrix printers and letter-quality printers.

Dot-Matrix Printers

The most popular type of printer is the dot-matrix printer. In 1976 reasonable quality dot-matrix printers cost over $3,000. Today they are available for as little as $299. Their speeds can exceed 400 characters per second for sophisticated applications, such as statement and billing processing. However, the faster the printer, the higher the price. Whatever the price, dot-matrix printers are fast and have low maintenance costs.

Dot-matrix characters are formed by a printhead that contains a number of pins and travels back and forth along a bar in front of a sheet of paper. As its name — dot matrix — implies, the characters are formed from columns of dots. As the printhead travels across the paper, the pins strike a ribbon that places on the paper a specific cluster of dots for each character. The following is an example of how three characters are formed.



The matrix has specified resolution — that is, a specific number of dots that form a character. The measurement is given in a form that indicates width in dots (horizontally) by height in dots (vertically). For example, a 7 x 9 matrix is 7 dots wide and 9 dots high. Some common matrices are 5 x 7, 7 x 8, and 9 x 14. Smaller matrices, such as 5 x 7, do not allow for **lower case extenders,** the tails of the lower case letters g, j, p, and y that extend below the imaginary base line. The absence of lower case extenders decreases legibility because these letters become raised above the line to accommodate their tails. As a general rule, the higher the number of dots of resolution, the more legible the character.

Most dot-matrix printers are thought to be of draft, not letter, quality. With higher matrices, however, the print quality approaches that of a typewriter.

Dot-matrix printers can use regular sheets of paper, computer paper, or both. There are three ways to feed paper: friction, pin, and tractor feeding. Friction feed is like that used on a typewriter: the platen, as it turns, moves the paper by friction through the mechanism. Both pin and tractor feeds use paper with holes on each side. A pin-feed printer has pins fixed to the platen; therefore, only paper whose holes match the width of the pins can be used on this kind of printer. A tractor-feed printer, which has adjustable tractors to handle paper of various widths, offers greater flexibility.

Another point to consider about a printer is its speed. The fastest printers are bidirectional: the printhead prints characters while moving in either direction. Unidirectional printers print a line of characters, allow the printhead to return to the leftmost position, then print the next line of characters. Bidirectional printers offer immediate speed advantages.

Most printers are rated in **CPS,** or characters per second. A CPS figure is the maximum number of characters that can be printed in a second. The price of a dot-matrix printer is related to its speed; the faster the printer, the higher the price.

Some dot-matrix printers can print **bit-plot graphics,** which form a picture consisting of thousands of dots. Although this feature can be useful for plots and drawings, the Osborne 1 does not support bit-plot graphics. Special software must be either obtained or written to

use this printer feature. However, some of the Osborne 1's video graphics characters may be printed with the appropriate printer and software.

If multiple-part forms are to be printed, it is wise to investigate the maximum thickness the printer can handle. This information can usually be found in the printer's sales literature, but it is best to test the printer before buying it.

Most dot-matrix printers use the standard "Centronics" parallel method of communication with a microcomputer. This protocol can be used with the Osborne 1 through the IEEE-488 jack, an appropriate adapter cable, and the proper selection in the SETUP program. The *User's Reference Guide* gives examples and illustrations.

Many dot-matrix printers offer an optional RS-232 interface. Since the Osborne 1 has both IEEE-488 and RS-232 jacks, either interface may be chosen. However, if a device such as the Corvus hard disk is used with the IEEE-488 jack, a serial printer should be selected. The IEEE-488 port cannot use two different devices simultaneously. If any IEEE-488 device is to occupy this port, a printer with the appropriate serial interface should be selected.

Some dot-matrix printers will perform character fonting, such as boldfacing, doublestriking, and providing superscripts and subscripts. In fact, some can also handle foreign language characters or proportionally spaced printing. Such features can be used by sending special sequences of characters, called **printer-control** strings, to the printer.

Control strings vary from printer to printer because printer features vary widely. A leading cause of concern among programmers is a lack of standards in printer-control strings. Fortunately, the novice user does not need to learn these commands for simple use of the printer.

In word processing, where special characters are desirable, WordStar offers flexibility. The installation program for WordStar supports many different printers, but it is best to be certain that WordStar supports a particular printer before acquiring it.

The installation program for SuperCalc permits a group of characters to be sent to the printer each time SuperCalc is used. Most

owners will find this "initialization" string helpful in switching to compressed print. Printers such as the Epson MX-80™ typically print 80-column lines. However, through a special control-character sequence, the Epson can switch to compressed print and have 132-column lines. This is the purpose of the printer string. Epson owners can install commands to switch the printer to compressed print and use the 132-column format. When this format is installed into SuperCalc, the printer will be set up correctly each time the program is run.

Letter-Quality Printers

The second popular microcomputer printer is the daisywheel printer. It is similar to an IBM Selectric™ typewriter in that an electromechanical mechanism moves from left to right in front of the paper. The print wheel, or daisywheel, has fingers on a central hub. The wheel spins, and, as a character comes into position, a hammer strikes the finger containing the character.

The finger, in turn, strikes a ribbon that makes an impression on the paper. The character is fully formed and equal in quality to that made by a typewriter. That is why daisywheel printers are called "letter-quality" or "correspondence-quality" printers.

The print wheels used in these printers come in a variety of fonts, sizes, and styles. The wheel may be plastic or metal; metal print wheels last longer, but are more expensive and less popular. Most letter-quality printers use the daisywheel. The major exception is NEC™, whose Spinwriter™ printers use a print wheel called a thimble, which resembles a sewing thimble.

The three big names in letter-quality printers are Qume™, a division of ITT; Diablo™, a division of Xerox; and NEC. Since the inception of the daisywheel printer in 1972, these three manufacturers have dominated the market. Recently, other companies have introduced letter-quality printers with lower speeds and lower prices. Traditionally, letter-quality printers cost between $2,200 and $3,400. Some low-speed models currently can be purchased for under $1,000.

In addition to fully formed characters, letter-quality printers offer character fonting and spacing features not found on most dot-

matrix printers. Also, most letter-quality printers can handle various kinds of paper, from single sheets to tractor-feed continuous forms in a variety of widths and plies. Letter-quality printers can provide boldfacing, doublestriking, superscripts, subscripts, incrementally spaced characters, proportionally spaced characters, and a variety of character styles, such as italics, gothic, OCR (optical character reader for light pens), and foreign language characters. Because of these features, letter-quality printers have higher prices.

In other points of comparison, most dot-matrix printers use parallel communication between the computer and the printer, but letter-quality printers use serial communication. They also have software handshaking so that characters are not lost.

If, after all points are weighed carefully and particular needs are identified, the printer's primary purpose is to produce correspondence, and speed and price are not important concerns, a prospective buyer should seriously consider the purchase of a letter-quality printer.

Other Facts about Printers

When selecting a printer for use with the Osborne 1, the prospective buyer should consider several other features. One such feature is an optional **memory buffer** offered with many printers.

The purpose of the memory buffer is to free the computer's attention from the task of printing. All printers operate on one character at a time. When a computer "talks" to a printer, the computer transmits one character at a time. If a three-page report or letter is to be printed, the computer will send one at a time each character on the page. As the document is being printed, the faster working computer often has to wait for the slower operating printer to complete its printing of the characters. While the computer is waiting, most of its attention is on the printer, and no other processing takes place.

The buffer acts as a temporary holding place for the characters until they can be printed. The buffer varies in size, but typically holds approximately 2,000 characters. When using a printer buffer, the computer transmits to the buffer as many characters as it can hold. The slower printer removes these characters from the buffer and prints them. When the buffer is partially empty, the computer sends

more characters to the buffer for printing. This process continues until the computer has transmitted all the characters in the document. After the final transmission is sent, the computer can be directed to resume work on the task at hand or turn to some other task while the printer finishes its printing. Depending on printer speed, a 2K buffer that holds 2,048 characters can free the computer from the printing task 5 to 20 seconds sooner than without the buffer. Hence, a printer buffer may be a worthwhile investment, especially if the printer is used often.

Portability may be an issue in selecting a printer for the Osborne 1. With the battery pack, the Osborne may be operated anywhere. However, the battery pack does not have enough power or the proper connections to operate the Osborne 1 and a printer. Because most printers need AC power, they can be operated only where AC power is available. This limitation restricts the portability of the Osborne 1 if a printer is involved.

The weight and size of a printer are other factors that need to be considered for portability. The faster the printer, the heavier it will be. Also, a printer that handles wide paper or a variety of multiple plies usually will be larger. Most dot-matrix printers that print faster than 100 CPS weigh between 30 and 70 pounds. Most letter-quality printers exceed 30 pounds. If, however, the printer will always be in a fixed location, weight and size are not important issues.

Most printers can take the stress of travel, but few printers are as rugged as the Osborne 1 computer. They will not take the abuse the Osborne 1 can tolerate. If a printer is to travel frequently with the computer, a carrying case for the printer is recommended.

If the prime requirement for the printer is portability, and the owner will not be using the printer for professional correspondence, a light, sturdy dot-matrix printer may be the answer. This choice, however, reduces both the number of features available and the quality of the printing. Typically, small, light, dot-matrix printers do not operate faster than 100 CPS, nor do many of these printers have extensive character fonting. But if portability is essential and letter quality is not important, a small dot-matrix printer is ideal.

Communications with the Printer

Dot-matrix printers usually employ a parallel method of communications, whereas letter-quality printers use the RS-232 serial method. However, most manufacturers of these printers offer the opposite interface method as an option.

The Osborne 1's SETUP program supports the following communication standards for printers:

- RS-232 Standard (Mark polarity)
- RS-232 XON/XOFF protocol
- RS-232 ETX/ACK protocol
- "Centronics" parallel
- IEEE-488

The standard serial selection accommodates most dot-matrix serial printers. This method uses hardware handshaking. For the computer and printer to operate properly, the computer must monitor either the 5th or 20th RS-232 lines (Clear to Send and Data Terminal Ready, respectively). When held logically high by the printer, the computer will transmit characters. When held logically low, the computer will pause and not transmit characters until the printer signals its readiness to accept more characters by forcing the Clear to Send or Data Terminal Ready line high again.

Many letter-quality printers use the XON/XOFF or ETX/ACK software protocol for serial communications. These protocols use special characters to control the flow of characters from the computer to the printer. The physical connection between the computer and printer is the RS-232 port.

IEEE-488 printers will use the IEEE-488 jack on the front panel of the Osborne 1. The electronic signals employed by IEEE-488 communications for printers are similar to those used by the parallel method. An adapter must be fashioned or bought to convert the flat, edge connector of the Osborne 1 to the IEEE-488 connector. In addition, the printer must be set up as device 0 on the IEEE-488 bus, or else the printer will not function properly with the current Osborne 1. This problem with device 0 is resolved with the double-density upgrade. After installation, the operator can select which

device number the Osborne 1 should use through the new SETUP program. The new default device number is 4, a commonly used device number for printers and plotters. If the printer is not set up as device 4, the new SETUP program should be used to adjust the Osborne 1's BIOS to the correct device number.

Most parallel printers use a "Centronics"-style connector and protocol. As is true for the IEEE-488 printers, a suitable adapter must be used to convert the IEEE-488 edge connector for the Centronics type of printer.

The most common problems in interfacing serial printers are incompatible RS-232 lines and improper signal polarity. These problems can occur in two areas: DTE-DCE assignment, and the use of different lines for handshaking between the computer and the printer.

The Osborne 1 is configured as Data Terminal Equipment (DTE). It sends information to the printer on pin 2 of the RS-232 connector and receives data on pin 3. Some printers receive data on pin 3 and send data on pin 2, just as the Osborne 1 does. For those that do, pins 2 and 3 on one end of the connecting cable between the printer and the Osborne 1 should be reversed. This reversal will make the printer appear as Data Communication Equipment (DCE), and thus make it compatible with the Osborne 1 computer.

The other problem area with standard serial printers is their use of different lines for hardware handshaking. The Osborne 1 monitors pin 4 (Request to Send) and pin 20 (Data Terminal Ready), the most common handshaking lines. If the printer uses a different line for handshaking, the connection cable should be altered to connect the printer's line with either pin 4 or pin 20 of the Osborne 1.

Improper signal polarity in hardware handshaking can occur with serial connections. The Osborne 1 expects to see a high signal on either pin 4 or pin 20 when the printer is ready, or a low signal when the printer is not ready. Most printers, however, can be set for this method and have a switch or jumper to match the printer's handshaking polarity with that of the Osborne 1.

The major problem in connecting IEEE-488 devices is that often a device is not set up to be addressed as device 0 (or device 4 on the double-density equipped Osbornes). This problem can be solved

by changing a jumper inside the printer, using a software patch that may be obtained from an Osborne dealer (for native Osbornes), or by running the new SETUP program (for upgraded Osbornes).

More problems will occur when connecting a Centronics-style printer to the Osborne 1 than when interfacing a serial printer. These problems arise because many printer manufacturers claim that their printers are Centronics-compatible when they are not.

There is no simple, universal solution to the problem of improper polarity in handshaking. Before purchasing a printer, the prospective buyer should test the printer with the Osborne 1 computer for proper operation. Testing will insure that the printer functions properly and determine whether any modifications should be made by the printer's vendor.

The Osborne 1 computer can operate with most printers on the market. An owner, therefore, is free to choose whatever printer best meets personal requirements.

Summary

The Osborne 1 computer is amply supplied with accessible, compatible jacks that enable the computer to be connected to important peripherals, such as a modem, a printer, or an external video monitor. These peripherals help to make the Osborne 1 versatile in its operations. Another external device, the battery pack, makes the Osborne 1 portable. Much of the appeal of the Osborne 1 lies precisely in the fact that it is a portable computer that also is highly versatile.

Chapter 4
System Software

A computer system is composed of both hardware — the computer itself and any peripherals — **and** software. **Software** is the operating instructions used by the computer to complete tasks. The system cannot work without software.

The general public is attracted to the Osborne 1 computer by its portability and low price, but experienced microcomputer users value the software package that comes with the Osborne 1. Many computers come with no software at all, and few are packaged with more than one or two programs. Software, however, gives personality and functionality to a computer system; and the Osborne Computer Corporation took the unusual approach of including with the computer the operating system software, two programming languages, and two popular applications programs.

The Osborne Approach to Software

Most microcomputer users face two problems related to software: the *cost* of software that is needed to make a system useful, and *incompatibility* between the software and the hardware.

The Problem of Software Cost

After spending several thousand dollars on a computer, a new owner will discover that the system is incomplete. Extra costs for fundamental software (the operating system and one or more program-

ming languages) and two or three applications programs can easily be more than $1000. An operating system and at least one programming language are necessary software investments. With these tools, a skilled operator can write any program for the computer system. The initial software investment for just the operating system and a programming language is between $300 and $500.

An alternative would be to contract a skilled programmer to set up the operating system. If customized software is desired, then the cost of custom programs and the time invested in writing them would be additional. Customized software packages vary in price from under $100 to thousands of dollars. Custom software is the *only* solution if packages capable of doing required tasks are not available.

Prewritten software packages vary widely in price. Entertainment software is inexpensive, ranging from $30 to $100. In a middle range, word-processing software is priced from $75 to over $300, and spreadsheet programs are available for $175 to $400. However, sophisticated accounting programs for business can cost as much as $5,000! The Osborne 1's software package is an attempt to solve the problem of software cost.

The Osborne 1 Software Package

As indicated earlier, OCC bundles with the Osborne 1 computer a software package that consists of five major software programs. These programs are of high quality and include the operating system, two versions of BASIC, a spreadsheet program, and a word-processing program.

Because three of the largest software companies in the U.S. (Digital Research, MicroPro International, and Microsoft) are partners in the Osborne Computer Corporation, OCC can include products of these companies in the software package for the Osborne 1 at a substantial saving to the consumer.

The software that comes with the Osborne 1 is significant. If purchased separately, the various programs would cost over $1,400. If the retail value of the software is subtracted from the $1,795 price of the Osborne 1, the net price of the computer is $395. Or, expressed another way, for a total outlay of $1,795 a buyer can get a

specific amount of software, plus a significant computer for $395! Clearly, the Osborne 1 with its software package is both a valuable and an affordable investment.

Despite the impressive collection of software that comes with the computer, OCC has not totally solved the software problem. Most users will want additional programs. Students and teachers will need educational programs, businessmen will want bookkeeping and inventory programs, and engineers will require mathematical packages. However, by providing fundamental software with the system, Osborne has greatly reduced the cost of the needed software programs.

The Problem of Software Incompatibility

Incompatibility is the other software problem faced by microcomputer users. Programs that work on one manufacturer's system may not work on another. Although a program may be written in the same programming language, such as BASIC, differences in BASIC dialects may make the program unusable on another system. Microsoft BASIC is used by Apple, Commodore, and Tandy, but each company uses a different dialect. Many of the dialectical differences appear in disk storage commands, a matter related to the operating system. It is true that most program statements would work in any of the three versions of BASIC, but the more powerful statements related to the handling of characters, screen formatting, and string usage (e.g. PRINT USING) do not have exact counterparts in various versions of BASIC.

The problem of software incompatibility is so severe that prospective computer buyers are advised to select the appropriate accounting, education, entertainment, financial planning, or word-processing software *before* choosing the computer system.

The Osborne Response to Software Incompatibility

OCC has reduced program incompatibility somewhat by selecting for the Osborne 1 the Z80 microprocessor and the CP/M microcomputer operating system. These popular systems, used by many computer manufacturers and independent software publishers, give Osborne 1 owners access to a large bank of software.

Selection of an industry-standard microprocessor and operating system assured the maximum compatibility possible between the Osborne 1 and other microcomputers.

There are more programs available which will run under CP/M than under any other operating system, and a high percentage of these programs can easily be converted to run on the Osborne 1.

In addition, Osborne's Approved Software policy has no known parallel in the industry. Osborne modifies popular programs for optimal use on the Osborne 1. With 70 programs converted for Osborne by the end of 1982, the Osborne library is expected to reach 200 during 1983, and to continue to expand at the rate of 10 to 15 programs per month.

Programs written for non-Z80, non-CPM computers, like the Apple or Tandy, will not operate on the Osborne, and some machine-specific programs written for specific Z80 based computers will not run.

The CP/M Operating System

Every computer has an operating system, which is a set of programs that controls the computer's resources and directs the operation and flow of information from the CPU to devices such as the keyboard, the printer, and the monitor. These programs are stored in the ROM (read-only memory), on a floppy diskette, or a combination of the two. Every character of information typed on the keyboard, displayed on the screen, stored on the floppy diskette, or printed on the printer is handled by the operating system.

As indicated earlier, the operating system of the Osborne is CP/M (Control Program/Microprocessor), which is a disk operating system (DOS). The operating system itself resides on a floppy diskette that is loaded into RAM memory. Because the entire system is on a disk, most improvements (upgrades) to CP/M can be made simply by shipping a new diskette to the owner. ROM-based operating systems, such as those using the double-density option, need a serviceperson to replace the old ROM(s). For this reason, a diskette-based operating system has more flexibility than a double-density system.

The nature of CP/M as a disk operating system can best be understood by a brief look at the origin of CP/M.

A Brief History of CP/M

Dr. Gary Kildall, who worked for Intel at the time, and a group of computer enthusiasts wrote a high-level programming language compiler for the 8008 Intel chip. The CP/M system was created initially to assist in the development of the compiler. With this system, programmers could quickly load and save their work on paper tape punches and readers. Then more routines were added, using the popular "high-speed" floppy disk drives.

CP/M made its debut at a demonstration of a working floppy disk controller card and CP/M given by Digital Systems for the Los Angeles Home Brew Computer Club in 1975. Digital Systems, the first CP/M OEM (original equipment manufacturer), is now owned by Extel Corporation.

In 1975, Dr. Kildall, now Chief Executive Officer of Digital Research, Inc., incorporated in CP/M a text editor, machine-language assembler, and a machine-language debugging tool. Today, the family of CP/M products includes a multiuser, multitasking version (MP/M), a networking version (CP/Net), and versions of CP/M for the Intel 8086 16-bit microprocessor (the CP/M-86 family). Work still continues on CP/M for the Motorola 68000 16/32-bit microprocessor (CP/M-68K), the Zilog 16-bit Z8000, and the National Semiconductor 16/32-bit 16032.

The union of the 8008 microprocessor and the floppy disk was best summarized by Tom Rollander, Vice-President of Operating Systems at Digital Research: "Gary (Kildall) saw stop lights and floppy drives and knew there was more that could be done." ("Stop lights" refers to the use of microprocessors in traffic signals.) As a storage medium, the floppy disk offered an "ultra-speed" improvement over paper tape. The combination of the floppy disk and the microprocessor in one operating system revolutionized the microcomputer industry and led to the development of an industry-standardized operating system.

The Transportability of CP/M

CP/M is a popular operating system. Used by 500,000 microcomputer systems, CP/M has become the de facto standard for 8-bit microcomputers. Because the operating system is such a standard,

most programs run on one CP/M-equipped computer can be transported and used with little or no alteration on a dissimilar CP/M-equipped computer. This transportability increases the amount of software available to CP/M-based computer owners and accounts for CP/M's popularity.

Any computer with a floppy disk drive and the appropriate microprocessor (CPU) can use CP/M. CP/M-80, written for the Intel 8080 CPU, is the version used in the Osborne 1. Most of the following discussion relates to CP/M-80, which should not be confused with CP/M-86, a version now available for the 8086 and 68000 CPUs. A new generation of CPUs, the Intel 8085 and the Zilog Z80, are compatible with the 8080, and CP/M-80 operates on computers based on these three CPUs.

Recently, DEC, Lanier, Wang, IBM, and Xerox joined Osborne, NorthStar, Apple, and Zenith in offering use of the CP/M operating system. At present, 200 other companies are licensed to offer CP/M, and the number continues to grow.

As more companies offer CP/M, it should be kept in mind that *not all* CP/M-based computers can run all CP/M-based software. For example, the Osborne 1 cannot use directly a CP/M diskette from an Altos or Zenith computer. A prospective buyer should investigate thoroughly the question of transportability when considering specific hardware and software selections.

Software authors, however, with over 500,000 potential customers, have a great incentive to produce high-quality programs for machines using CP/M, particularly since *most* programs for CP/M *are* transportable, needing little, if any, modification to run on other computer systems.

CP/M and Applications Software

Quality and transportability make CP/M the vehicle for the most mature, business-oriented microcomputer software available today. CP/M offers the largest selection of capable microcomputer-based accounting software. Word-processing programs for CP/M rival dedicated word processors (i.e., word processors that do only word processing) in power and ease of use, and CP/M accommodates sophisticated programs for electronic spreadsheeting and planning.

CP/M, however, has not been as popular for entertainment and educational software. Before the advent of the Osborne 1, the amount needed for a CP/M-based computer was approximately $4,000, a price that discouraged potential buyers from using the computer only for entertainment or educational purposes. Buyers with such interests in mind were also discouraged by the fact that most CP/M-based computers use a monochrome CRT. CP/M computers seldom offered graphic characters or color, the capabilities used by most entertainment and education software. Because of these limitations, not much education or entertainment software has been produced for CP/M computers.

The Structure of the CP/M Operating System

CP/M is an **operating system.** A computer's operating system controls the use of its resources and regulates almost all information processed in the system. An operating system has two areas: the portions of software controlling the computer's resources, and the utilities provided for housekeeping operations.

CP/M Control Features

CP/M is divided into four subsections that control its resources: the BIOS (Basic Input/Output System), the BDOS (Basic Disk Operating System), the CCP (Console Command Processor), and the TPA (Transient Program Area). Each subsection relies on the foundation built by the preceding one.

Control Subsections

BIOS. The BIOS transfers characters from the CPU to the devices. By definition, the BIOS must contain the necessary information for communicating with each device. BIOS is the heavily customized part of CP/M. Customizing only one major subsection allows the rest of the CP/M operating system to be the same for all computer systems.

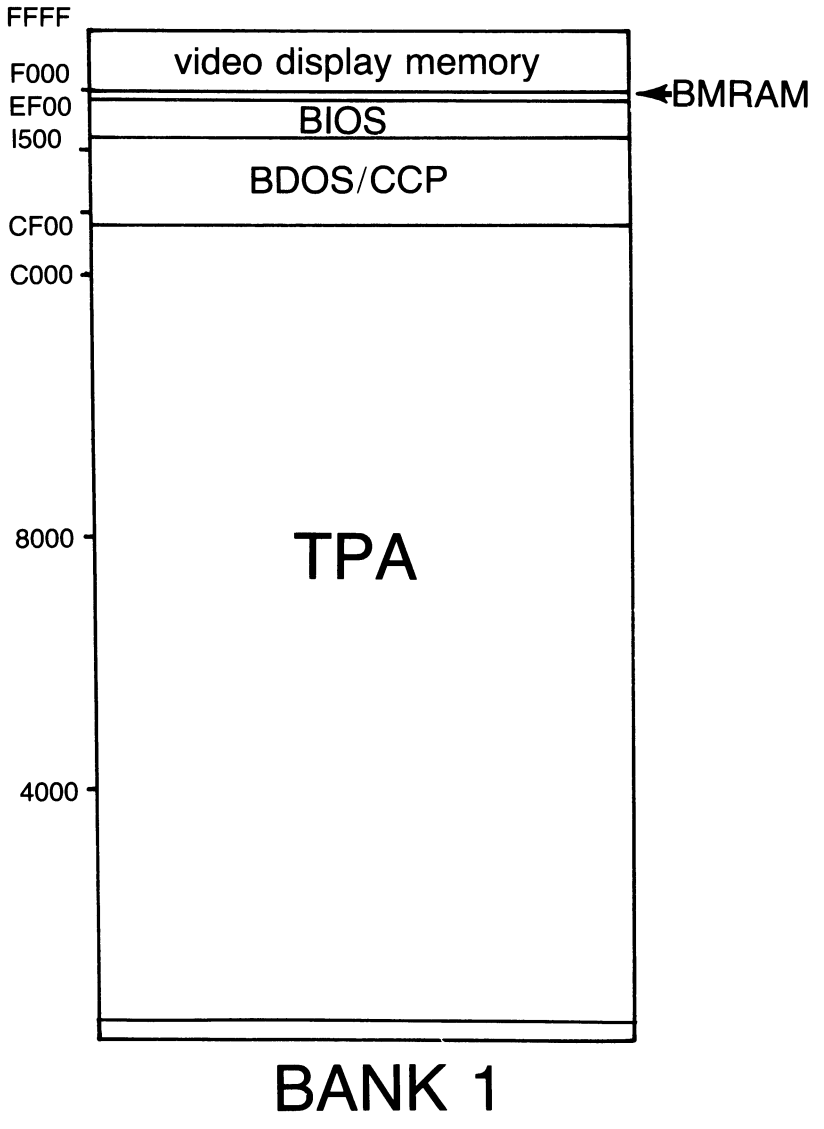
In the Osborne 1, the CP/M BIOS builds on the routines stored in ROM on the system board. The ROM, which resides in the second

memory bank, holds the basic routines for handling characters from the CPU, keyboard, video display, disk drives, and most other devices. A small portion of the RAM memory passes information from the ROM BIOS to CP/M's BIOS. This memory is located between the video display memory and CP/M's BIOS.

BDOS. The BDOS, the higher level routine used by most programs, builds on the BIOS's foundation. Most programs written in machine-language or in high-level programming languages like BASIC use BDOS's subprogram. The BDOS, standardized for most CP/M systems, contains the core of CP/M's disk filing system, plus routines for transferring information from the devices. It uses BIOS to perform the physical labor of transfer. The standardization of BDOS allows different computer systems to use most programs written for the CP/M operating system.

CCP. The third area of CP/M is the CCP. This software program contains several subprograms (see Table 4-1). The CCP loads and executes a user's program. Although CCP is a transient program, it resides in the computer when CP/M is loaded. After the program is loaded, the RAM space used by the CCP is free for other use. The CCP is reloaded from the disk when a program has finished, causing a small delay while CP/M performs a "warm boot," (i.e., reloading the CCP).

TPA. The fourth area of CP/M, the TPA, is the RAM space available for the user's program and data. The Osborne 1's TPA of 52K is slightly smaller than that of most 64K computer systems. Part of the remaining 12K is devoted to CP/M, which occupies 8K of RAM memory in most computer systems. The slight discrepancy is caused by the video display's need for 4K of memory.



The memory addresses of the various portions of CP/M used on the native Osborne. After the double-density disk drive option is installed, the BMRAM occupies 1/4K more space, moving the BIOS, BDOS, and CCP further down in memory and decreasing the RAM area for programs (TPA) by 1K (not illustrated).

Table 4.1

The following table is a list of CP/M commands for the Osborne 1 that can be used also on most CP/M computers.

CP/M Operating System Commands

Name	Description
ASM	Digital Research's 8080 assembly language program
AUTOST**	Turnkey program capability
COPY**	Formats and/or copies diskettes
DDT	Dynamic Debugging Tool, a machine-language programmer debugger
DIR*	Shows the directory (names of files) of a diskette
DUMP	Dumps (displays) the contents of a disk file in Intel hexadecimal (base-16) format
ED	Digital Research's line editor
ERA*	Erases (deletes) files
HELP**	Menu-driven help program
MOVCPM	Configures CP/M to the RAM memory size of the computer system
PIP	Peripheral Interface Program transfers files from disk drives or one of the peripherals
REN*	Renames files
SAVE*	Records (saves) a section of memory to the diskette
SETUP**	Configures the keyboard, I/O ports, and video display
STAT	Displays status and/or statistics of devices and disk space, and configures the I/O devices
SUBMIT	Allows a sequence of CP/M commands in a text file to be executed (batch processing)
SYSGEN	Places an image of the CP/M system in memory or on a diskette
TYPE*	Displays a file on the video screen
USER*	Changes or displays the user number
XDIR**	Displays file sizes and disk space statistics
XSUB	Used to extend the capability of SUBMIT

*designates resident commands (commands built into the CCP). All other commands/programs are

transient and must reside on a diskette in one of the floppy disk drives.

**designates an Osborne-supplied utility program.

CP/M uses control characters for certain functions. Holding the control (CTRL) key and pressing a particular letter will perform the desired function.

CP/MControl Codes

CTRL-C Rereads (warm boots) CP/M's CCP from the primary disk drive, if it is the first character on the line (This method can be to inform CP/M that a diskette has been changed, or to abort some programs in operation.)

CTRL-H Destructive (erasing) backspace

CTRL-J Moves the cursor down one line

CTRL-K Moves the cursor up one line

CTRL-L Moves the cursor right

CTRL-P Echoes information printed on the video screen to the printer

CTRL-R Redraws the currently typed line

CTRL-U Deletes the currently typed line

CTRL-X Destructively backspaces to the beginning of the currently typed line. **CTRL-X** erases the line on the screen, differing from **CTRL-U**, which drops to the next line on the video display.

CP/M control characters are always valid when the user is in the CP/M command level, which is shown by the A, or "A prompt." Some CP/M control characters are valid in programs, but others are not. Individual programs must be checked for compatibility.

The user should study the detailed descriptions and illustrations for each command in the *Osborne 1 User's Reference Guide*, which also explains each command and the inner workings of CP/M.

Housekeeping and Utility Programs

CP/M 2.2 has one basic shortcoming: its lack of friendliness. For example, the phrasing (syntax) seems backwards. The name of the

file that will be copied is given first, then the source file. CP/M's command names and error messages are cryptic. CP/M is also somewhat "overprotective." A user cannot change a diskette without informing the operating system. If an attempt is made to place information on a "fresh" diskette, CP/M will issue a fatal error, which will kill a program. The implementation of CP/M 3.0 should alleviate some of these problems.

The housekeeping and utility programs supplied with the Osborne help overcome the problem of CP/M's unfriendliness. Housekeeping programs, although essential for computer operations, do not do work directly. They format diskettes and set the speed for sending characters to the printer. Separate utility programs respond to the beginner's problems.

The five utility programs — **HELP, SETUP, COPY, XDIR,** and **AUTOST** — included in the Osborne 1 help make CP/M user friendly.

HELP

HELP is exactly what its name implies: its set of 26 screens of information acquaints the user with the system. The menus available include help on CP/M, file names, SuperCalc, WordStar, BASIC-80, CBASIC, accessories, and the self-portrait. The HELP program is automatically executed when the CP/M master diskette is "booted."

SETUP

The second program, SETUP, customizes or configures the Osborne's special features. With SETUP, the user can configure:

- the printer used (serial, parallel, and what communications protocol to use)
- the baud rate (character speed) of the serial port
- The logical and physical size of the video display
- the automatic scrolling of the video display (on or off)
- the definition of the special-function keys and cursor-control keys

The "setup" can be viewed, altered, or copied to another diskette. With this menu-driven program, the Osborne user can customize the configuration of the computer with little programming knowledge.

COPY

The COPY program can format (prepare) new diskettes to hold information and copy the contents of one diskette to another. Both functions can be selected from a menu after the program has run.

The formatting section of the COPY command prepares a blank diskette to receive information. When selected, the COPY program requests the name of the disk drive to be used. When the correct letter is entered, the program prompts the user to insert the new diskette and press the return key. After formatting the diskette, the program rereads (verifies) to see that it was done correctly. When formatting is operating accurately, the video screen shows each of the diskette's 40 tracks being formatted, then verified.

The track numbers start a 0 and end at 39. When a track has been formatted successfully, an "F" will appear under the numbers. A "V" shows that the track was successfully verified. When formatting a double-density diskette, an "" appears instead of the F or V. An "E" at any location indicates that an error has taken place, and that the diskette should be reformatted. Recurring "E"s indicate a defective diskette. If the system displays errors when formatting several diskettes, a disk drive hardware problem may exist.

The COPY program also copies entire diskettes. The COPY command, which is menu-driven, asks for the letter of the source drive (the diskette to be copied). Because the Osborne 1 has only two disk drives, the program assumes the other drive is the destination. During copying, the number of each track is displayed to assure the operator that the program is progressing correctly.

Although the COPY program is friendly, the user should be aware of two possible pitfalls: (1) The formatting portion of the COPY program destroys the contents of a diskette and, therefore, should not be used on a diskette with useful information because that data will be lost. (2) If the incorrect drive letter is used, the contents of a blank diskette could be copied onto a useful diskette, again destroying important data.

XDIR

XDIR, the fourth utility provided, is an extended directory of a diskette and includes the name and size of each file, the size of a basic disk "block" (the minimal size of a file), the total disk storage space, and the disk space that is used or available. Although the CP/M STAT program has the same capabilities as XDIR, the Osborne 1 program uses fewer keystrokes, is easily remembered, displays only relevant disk storage information, and occupies less space on the diskette. (XDIR occupies 4K, and STAT occupies 6K.) Space is important when diskettes with 92K of user storage are used on the system.

AUTOST

The final utility, AUTOST (auto start), is used by each master diskette to load and execute a second program. When the CP/M operating system is loaded from the diskette, or "cold booted," the operating system searches for AUTOST. If found, it is loaded into memory and executed. On the CP/M master diskette, the HELP program is loaded and executed by AUTOST. When booted, AUTOST loads WordStar on the word-processing master diskette.

The AUTOST program has turnkey capability; an application program is automatically loaded after CP/M is booted. With this program, the novice can turn on the Osborne 1, insert the correct diskette, hit the return key, and quickly start word processing, spreadsheeting, or other work without learning another CP/M command. AUTOST is therefore a valuable tool for the novice or infrequent user. A tutorial on assembly language programming in the *Osborne 1 User's Reference Guide* lists the AUTOST program and suggests modifications.

Although CP/M's syntax and cryptic programs are sometimes drawbacks, the Osborne 1's utility programs — HELP, COPY, XDIR, and AUTOST — help the user become proficient. These programs and a well-written user manual make CP/M more approachable.

The Programming Languages

An operating system is the foundation for controlling a computer system's resources. The next building block, the programming lan-

guage, transforms the user's statements into instructions the computer's CPU can understand. Programming languages develop applications software, which, in turn, perform accounting, entertainment, and word-processing functions.

The Osborne 1 supplies two versions of the BASIC programming language: Microsoft BASIC-80 and CBASIC. BASIC, the acronym for **B**eginner's **A**ll-purpose **S**ymbolic **I**nstruction **C**ode, is the most widely used programming language. This language, which is ideal for beginners, uses commands that are algebra-oriented and similar to English. BASIC is either supplied or sold with most microcomputers. Because they are more numerous than minicomputers and mainframe systems, BASIC is found on computers more than any other language.

Although BASIC is widely used, programmers would not declare it a clear winner in a popularity contest. Most programmers either swear by BASIC or *at* it. It is doubtful that even the developers of BASIC at Dartmouth College could have predicted its importance as a programming language. Although BASIC has won over many newcomers to computer programming, the language has also disgruntled experienced programmers who are frustrated at BASIC's limitations.

In a discussion of programming languages, it is important to know two programming language terms, interpreter and compiler, and their functions in the computer system.

An **interpreter** is a translator; it continuously interprets each "human" statement in the program, or **source code,** into statements the CPU can understand. Languages that use interpreters are easy to develop because the program can be rerun and tested immediately after changes are made.

A **compiler** changes the source code into **object code,** machine-language instructions the CPU can execute. Compiled programs are more difficult to develop than interpreted programs. When an error is made in the program, the text of the commands must be re-edited, recompiled, and tested. However, a compiled program executes 4 to 20 times faster than an interpreted program.

Microsoft BASIC-80

Microsoft's BASIC-80 is one of the two BASIC languages supplied with the Osborne 1 computer. The "80" refers to the CP/M version of the language for computers that use the Intel 8080 CPU or one of its derivatives, such as the Osborne 1's Z80. BASIC-80, in all forms, is the most popular version of BASIC. It is used by over 1,000,000 computer systems. Dialects of Microsoft BASIC will run on the Apple II, the Tandy TRS-80 family, the Commodore computer family, the IBM Personal Computer, and the DEC Rainbow 100™.

One reason for Microsoft BASIC's popularity is that many programs written in Microsoft BASIC can run on different computer systems. Although not all programs can be transported to the Osborne 1, BASIC-80's programs should work on any CP/M-based computer system. Subtle differences in hardware among CP/M-based computers can make transporting these programs difficult.

BASIC-80 is an interpreted language. Its programs constantly translate each line of the BASIC program. Therefore, programs can be developed and perfected easily, although they have slower rates of execution than compiled programs.

Microsoft BASIC-80 is located on one of the five Osborne 1 master diskettes under the file name MBASIC.COM. When it is loaded into RAM memory, it displays a sign-on message. BASIC occupies just under 24K of RAM, leaving over 29K for programs and data. At this point, a program may be typed or loaded into BASIC.

Commands are executed by BASIC-80 in either immediate or program mode. **Immediate mode** is indicated by an "OK" message. When commands are entered, they are executed immediately, which is useful for debugging or testing programs. **Program mode** indicates that BASIC is executing a program. This mode is used when a program is entered or loaded from the disk, and the command "RUN" is keyed.

Programs in BASIC-80 use whole numbers from 0 to 65529 as a prefix. Each prefix, or **line number,** is followed by a set of BASIC statements and commands. BASIC executes lines in ascending order, unless an instruction directs BASIC to jump (GOTO) to a

different line number or to perform a subroutine (GOSUB). Several statements can be combined on one line; the maximum line length is 253 characters.

Because BASIC is an algebraic language, it has many commands for manipulating numbers. BASIC-80 also has several powerful character-manipulating commands for handling **strings,** which are sequences of characters.

BASIC-80 has 135 different commands and statements, including many commands not found in other BASICs. One useful statement, PRINT USING, does columnar output of numbers. This command can be used in accounting and statistical work, where formatted columns of numbers with aligned decimal points increase legibility. Another group of commands, indicated by $, permits the manipulation of strings (groups of characters). The MID$ command, and others like it, can be used to process alphanumeric data, such as names and addresses.

BASIC-80 is an industry-standard language that increases the utility of the Osborne 1 computer. It is an interpretive language that can be quickly assimilated by both the novice and the experienced computer user. The inclusion of BASIC-80 in the Osborne software package gives the user access to the wide range of software packages designed for CP/M and Microsoft BASIC-80.

Commands

The following is a list of the commands for Microsoft BASIC-80:

AUTO	NAME
CLEAR	NEW
CONT	NULL
DELETE	RENUM
EDIT	RESET
FILES	RUN
LIST	SAVE
LLIST	SYSTEM
LOAD	TROFF
MERGE	TRON

Program Statements

The following are program statements for BASIC-80:

CALL	IF THEN ELSE	PRINT USING
CHAIN	INPUT	PRINT # USING
CLOSE	INPUT #	PUT
COMMON	KILL	RANDOMIZE
DATA	LETF	READ
DEF	LINE INPUT	REM
DEFN	LPRINT	RESTORE
DEF FN	LPRINT USING	RESUME (O)
DEF USR	LSET	RESUME NEXT
DIM	MID$	RETURN
END	NEXT	RSET
ERASE	ON ERROR GOTO	STOP
ERROR	ON GOSUB	SWAP
FOR	ON GOTO	WAIT
FIELD AS	OPEN	WHILE
GET	OPTION BASE	WRITE
GOSUB	OUT	WRITE #
GOTO	POKE	
IF GOTO ELSE	PRINT	

Algebraic and String Functions

The following are BASIC-80's algebraic and string functions:

ABS	HEX$	POS
ASC	INKEY$	RIGHT$
ATN	INP	RND
CDBL	INPUT$	SGN
CHR$	INSTR	SIN
CINT	INT	SPACE$
COS	LEFT$	SPC
CSNG	LEN	STR$
CVD	LOC	STRING$
CVI	LOG	SQR$
CVS	LPOS	TAB
EOF	MID$	TAN
ERL	MKI$	USR
ERR	MKS$	VAL
EXP	MKD$	VARPTR
FIX	OCT$	
FRE	PEEK	

Digital Research's CBASIC

Digital Research's CBASIC compiler is the second version of BASIC offered with the Osborne 1 computer. Although CBASIC is not as popular as Microsoft BASIC, it is used by many business-oriented programs. The difference between compiled and interpreted programming languages helps to explain the different uses of BASIC-80 and CBASIC.

Microsoft BASIC is an interpreted language. Each statement is converted into the CPU's language when the statement is encountered in the program. Compiled languages are converted only once. After a program is compiled, the source code becomes the machine-language instructions that the CPU can execute.

CBASIC, a hybrid of the two types, is a compiled-interpreted language. "Human" instructions are translated into a pseudocode. Then, the highly compressed pseudocode is translated by an interpreter. This process has two benefits. The first is that pseudocode files occupy less storage space on the disk drives than the original

program. This feature is important in systems with limited storage capacity. The second benefit is that a program author can distribute the compiled version freely. A competitor cannot easily steal the programmer's method of directing CBASIC's performance of a task. Such security is important for commercial and business software that has been developed at great cost and effort.

The CBASIC package has three different programs. The first, CBAS2.COM., is the actual BASIC compiler. It converts the source program into the pseudocode. CRUN2.COM, the run-time package for CBASIC, performs the necessary translation from the pseudo-code file to the CPU. The third program, XREF.COM, is a program development aid that lists the name and line number for each variable used in a program.

To develop a program in CBASIC, the operator must use a text editor to enter the BASIC statements and commands. CP/M's line editor, ED, or the nondocument (N) mode of WordStar may be used for this purpose. After entry is complete, CBAS2 is called with the CBASIC program's name. If no errors are detected, a file with the suffix of .INT (intermediate) is produced. To run the program, the operator must call up CRUN2 and the file name. Next, the CBASIC interpreter is loaded, followed by the intermediate file. When both programs are loaded, the CRUN2 runs the intermediate file.

Commands and Statements

CBASIC uses 85 different commands, statements, functions and directives. Although small in number, they are adequate for most BASIC programming. The following is a list of the commands and statements:

CALL	ELSE	LPRINTER	READ
CHAIN	FEND	NEXT	READ #
CLOSE	FILE	ON GOSUB	READ # LINE
COMMON	FOR	ON GOTO	REM
CONSOLE	GOSUB	OPEN AS	RESTORE
CREATE	IF	OUT	RETURN
DATA	IF END #	POKE	SAVEMEM
DEF	INITIALIZE	PRINT	STOP
DEF FN	INPUT	PRINT #	THEN
DELETE	INPUT LINE	PRINT USING	WEND
DIM	LET	RANDOMIZE	WHILE

CBASIC Functions

Below is a list of CBASIC functions:

ABS	FLOAT	MID$	SIZE
ASC	FRE	PEEK	SQR
ATN	INP	POS	STR$
CHR$	INT	RENAME	TAB
COMMAND$	INT%	RIGHT$	UCASE$
CONCHAR%	LEFT$	RND	VAL
CONSTAT%	LEN	SADD$	VARPTR
COS	LOG	SGN	
EXP	MATCH	SIN	

CBASIC Compiler Directives

The following list contains CBASIC's compiler directives:

%CHAIN	%LIST
%EJECT	%NOLIST
END	%PAGE
%INCLUDE	

Although these 85 different command, statements, and directives are fewer than those of Microsoft BASIC-80, the number is sufficient for most programming needs in BASIC.

The *Osborne 1 User's Reference Guide* devotes about 63 pages to CBASIC, the smallest number for any of the provided software programs. The manual contains reference material and many examples, but recommends that novice programmers purchase a book on programming techniques for CBASIC.

Comparing the BASICs

Since BASIC-80 and CBASIC are both supplied with the Osborne 1, a buyer does not have to decide between the two. However, a comparison of the two BASIC languages will show the Osborne owner why both were included with the system.

Although Microsoft BASIC-80 is the more popular of the two, with over a million systems using one of its versions, it is not necessarily the "best" BASIC programming language. Neither is CBASIC. Both kinds of BASIC have their advantages and limitations.

Generally, program development time is less with BASIC-80 than with CBASIC. Because Microsoft BASIC is interpreted, the programmer can run BASIC and enter, test, and edit the program continuously until the program is perfected. When an error is detected with Microsoft BASIC, the programmer can make corrections and rerun the program.

CBASIC is an interpreted compiler. The program must be typed into the system using a text editor, a program not supplied with the CBASIC language. CP/M's ED line editor may be used, but WordStar's nondocument editor is preferred. Compiling the text of the program is another separate step. If an error is detected in the program's phrasing, the programmer must return to the text editor to correct the mistakes. The program is then recompiled. If an error still exists, the editing and compiling steps are repeated until the program's syntax is correct.

Another advantage of BASIC-80 in program development is its ability to stop and review the information processed by the program. A CTRL-C, initiated by holding down the control key and striking the C key, will usually stop the program. The programmer can then print the contents of the variables used in the program. Small sections of the program can be run to ensure that the instructions used and the program flow are correct. This procedure is harder to accomplish with CBASIC.

CBASIC can build a large program from several, small subprograms. Each subprogram, or module, is created and perfected separately. Modules usually serve only one or two specific functions in a program. After a module is perfected, it can be used in many different programs. When the "%INCLUDE" command is used in the main program, it directs the compiler to incorporate the subprogram into the main program. Modules are useful tools for rapid program development.

Both CBASIC and BASIC-80 use line numbers, which precede each program statement line. In BASIC-80, each program line is executed in ascending order. CBASIC ignores line numbers, except when executing a jump-to-a-line (GOTO) statement or performing a subroutine (GOSUB) statement. A CBASIC program without a GOTO or GOSUB command can be written without line numbers. In

this case, CBASIC has the advantage over BASIC-80 because most programmers prefer writing a program with a minimum of line numbers.

In BASIC, a **variable,** the alphanumeric name for data handled by the computer, can be any one of the following: integer numbers (whole numbers ranging from -32768 to +32767), floating point numbers (real numbers), or strings (groups of alphanumeric characters). Variable names can be up to 36 characters in length in BASIC-80, and 31 in CBASIC. Long variable names increase program legibility. For example, the variable name "MONTHSTOPAY" is easier to understand than the shorter "MP." In CBASIC, the period can also be used in a name, allowing an even more legible name of "MONTHS.TO.PAY."

Defined functions, a more technical aspect of programming, are another area that favors CBASIC. A **defined function** is similar in purpose to a subroutine. Microsoft BASIC-80 has single-line defined functions, whereas CBASIC has the more powerful multiple-line functions.

If speed is a consideration, Microsoft BASIC-80 manipulates strings with twice the speed of CBASIC and handles real numbers 30% faster. BASIC-80 is also marginally faster than CBASIC in disk operations; however, CBASIC handles integer numbers 55% faster.

This time difference in handling real numbers is caused by the different methods BASIC-80 and CBASIC use to store and manipulate numbers. Microsoft uses a **binary floating point**; CBASIC uses a **binary coded decimal** (BCD). Binary floating point, although faster, is less accurate than BCD. Microsoft has both single-precision (7 digit) and double-precision (14 digit) numbers, but CBASIC offers just the latter. Although both kinds of BASIC are accurate on numbers located before the decimal point, CBASIC is very accurate on digits located to the right of the decimal point. BASIC-80 is just moderately accurate. If a high degree of accuracy is needed for numbers after the decimal point, CBASIC is superior.

BASIC-80 has a higher user-friendly rating than CBASIC. In addition to having more built-in functions than CBASIC, BASIC-80 has error handling, a feature that takes care of unusual errors during a program run. Errors that could terminate the program are "trapped"

by the error-handling routine. This routine, coupled with the descriptive error messages provided by BASIC-80, helps the programmer make friendlier and more "bulletproof" programs.

Program security is a feature of both BASIC-80 and CBASIC. When a program has been saved with BASIC-80's "P," or protect, option, the program may not be listed (the program lines displayed on the screen or printer) or altered, although the user can get programs that reverse this process. With CBASIC, it is impractical to reconstruct a source file from a compiled, intermediate file.

Both BASIC-80 and CBASIC have true compiler counterparts. Microsoft's BASIC Compiler can translate programs written in interpretive BASIC into machine-language programs. Digital Research's compiler counterpart, CB-80, has not been made available on the Osborne 1 disk format by OCC; therefore, comparisons cannot be made at this time.

The inclusion of BASIC-80 **and** CBASIC in the Osborne 1 software package can only benefit the Osborne 1 owner. However, the prospective buyer or new computer owner should understand the two languages and be aware of their intended purposes. By offering the popular BASIC-80, OCC gives newcomers a friendly pathway to learn the BASIC programming language. With CBASIC, Osborne 1 owners can program BASIC to advantage in a more commercial setting. Having both languages, the Osborne 1 owner can use many other programs.

Summary

The CP/M operating system, the Microsoft BASIC-80 programming language, and the Digital Research CBASIC interpreted compiler are three of the five bundled programs for the Osborne 1. (The other two programs — WordStar and SuperCalc — are discussed in Chapter 5.) The CP/M operating system fulfills Adam Osborne's demand for an industry-standard operating system that allows compatibility among dissimilar computer systems. The Osborne 1 utility programs and documentation help the novice or infrequent operator approach the "unfriendly" CP/M operating system.

With two popular versions of BASIC, the Osborne 1 owner has immediate access to the world of BASIC programs. Novice operators can begin writing programs with the friendly Microsoft BASIC-80. More experienced programmers can create and perfect programs with CBASIC.

Chapter 5
WordStar and SuperCalc

Included in the software package supplied with the Osborne 1 computer are two applications programs: WordStar and SuperCalc *applications programs* are sets of software that perform specific tasks. Unlike *utility programs*, which manage the computer system's resources, applications programs do the actual work requested by the user.

WordStar

WordStar, published by MicroPro International Corporation, has powerful capabilities that make it the most popular CP/M-based, word-processing program.

The version of WordStar currently provided with the computer is 2.26. With the exception of help menus, columnar operations (column move, copy, and delete), and menu selection of SpellStar, MicroPro's spelling checker/corrector program, WordStar 2.26 and the later version 3.0 are functionally the same.

Word Processing with WordStar

Those who have never used word-processing software are impressed by the capabilities of WordStar. Editing electronically with Wordstar, an operator can type as if using a typewriter; delete mistakes with a few keystrokes; insert or delete letters, words, phrases, or whole paragraphs; and move sections with minimal effort. After a

particular document, letter, or contract is perfected, it can be stored on disk and printed. The saved copy may be revised later, if necessary.

Preliminary educational research indicates that the use of word processing greatly improves writing style and quality. As an indication of the efficiency of Wordstar, it was used to write this entire book, the first draft having been written on an Osborne 1 computer.

WordStar is a powerful word-processing program for microcomputers. It rivals, but does not surpass, many dedicated word-processing systems (i.e., systems that do only word processing). Those who have had experience with dedicated word processing can learn to use WordStar with little difficulty, but even those without word-processing experience will soon find WordStar a powerful tool for the production of letters, contracts, reports, or manuscripts.

Some of the major features of WordStar are listed below:

- Upper and lower case letters displayed on-screen
- A menu-driven set of primary commands with 3 levels of on-screen help messages
- On-screen formatting of text as it will be printed
- Extensive commands for editing, block movement, block read, block write, search, and search-and-replace
- Paragraph reforming within margins, either left justified, like books and magazines, or ragged right, normal typewriter style
- Definable left and right margin settings, changeable anywhere in the text
- Unlimited number of operator-definable tab stops and decimal tab stops (for aligning the decimal points in a column of numbers)

MailMerge Option

MailMerge, an optional program for WordStar, is included with the Osborne 1 computer. MailMerge is designed for the repetitive print-

ing of legal documents or form letters. Boilerplate sections of text, often standardized paragraphs or pages, are placed in a separate text file. The MailMerge option can join together these boilerplate sections as a document is printed. MailMerge also rejustifies the text as required so that the various text files appear as a single document.

A feature of MailMerge that lawyers find useful is its ability to insert into a standard document typing from the keyboard. A standard form, such as that commonly used in writs and pleadings, can be entered into a text file. Special commands are placed in the text designating where information typed on the keyboard is to be inserted. When merge-printing begins, the computer pauses at the designated locations and requests information from the operator. After all the insertions are made, a complete form is printed. However, the information that was inserted is not retained in the text file.

MailMerge can also be used for quotations or contracts, which also contain much fixed text. A name, address, part number, description, or price can be entered quickly and the document printed.

MailMerge can produce form letters. Using special MailMerge commands, an operator can enter and store a standardized letter. At this point, MailMerge can access a data file containing a set of names and addresses and produce scores of personalized letters. This feature is useful for publicity mailings and collection letters.

Evaluation of WordStar

As provided software, WordStar adequately addresses most word-processing needs. It is the only word-processing program found on most Osborne 1 computers.

One drawback of WordStar is that it requires much time for the development of proficiency. WordStar is a complex program: most commands are two or three keystroke sequences. Although on-screen help is provided, most beginners need 30 to 40 hours to become familiar with WordStar's various functions and commands. Newcomers to word processing should be prepared to spend several hours over several days before useful, productive work can be

performed. Ultimately, however, the time spent in training and practice should result in significantly improved text handling.

The following Que Evaluation Chart provides additional information about the capabilities of WordStar:

QUE BUSINESS SOFTWARE EVALUATIONS

WordStar/MailMerge

(Version 2.26)

A Word-Processing Program Published by:
MicroPro International Corporation
33 San Pablo Avenue
San Rafael, CA 94903
415/499-1200

Date of version release:	January 28, 1981
Date of first release:	April 25, 1979
Number of copies sold:	Not available

Price: WordStar/MailMerge included in system price

Computer Equipment Required:

CPU type:	8080, Z80, or 8086 families
Memory:	48K
Compatible terminals:	Most with direct cursor control
Other operating systems:	CP/M-86 and MS/DOS

WordStar Evaluation

WordStar, a powerful word-processing program for CP/M-or MS/DOS-based computer systems, dynamically displays on the video screen the text as it will be printed. With decimal tabbing, the ability to edit lines up to 128 characters in width, and Osborne's video display scrolling, WordStar is excellent in producing short- and medium-length reports, as well as very large documents.

The package provided by Osborne Computer Company includes MailMerge, which is a merge-print program that permits printing information from a data file into the text of a document. MailMerge may also be used to print one large document from several, smaller text files.

Because WordStar is both powerful and versatile, it is also complex. Its command structure is difficult to learn, and a user needs much time to gain proficiency.

FEATURES

1. WordStar displays the justified text while it is being edited. This what-you-see-is-what-you-get feature may eliminate some draft printing and, therefore, increase overall efficiency.
2. The program offers comprehensive insert, delete, search, search and replace, and block operations commands.
3. Most disk housekeeping commands (copying, deleting, renaming files, and displaying the directory) are selectable from the main menu.
4. The MailMerge program allows the use of outside data files and the merging of other documents, which occurs when the document is printed.
5. WordStar offers multiple levels of help menus. The level of help is selectable. This features gives the novice user detailed help and does not impede the experienced user who needs little or no help.
6. WordStar uses disk buffering, which allows the created text files to exceed tne size of the Osborne's RAM memory.

7. WordStar is compatible with other MicroPro products, such as DataStar™, a data entry program, and SuperSort™, a file sorting utility. WordStar is also compatible with other programs that use standard ASCII text files.
8. A document may be printed while editing continues on the same or different document.
9. A full set of font commands (bold face, underscore, etc.) is supported by the program. An operator may elect to display the embedded control characters that enable these commands, or may suppress their display while editing the document.
10. WordStar works in a continuous editing mode, which means that the operator does not leave the "inserting" mode to correct, delete, or move text in the document. This feature is especially helpful for weak or marginal typists by allowing them to correct mistakes more readily.
11. The WordStar editor may be used in a nondocument mode, useful for creating data files or editing the text of a program.

LIMITATIONS

1. Because of the complexity of WordStar's command structure, a novice user's efficiency is low.
2. The optional MailMerge package does not provide acceptance criteria. For example, a letter cannot be sent only to lawyers if the file contains the names and addresses of other professionals in a randomly ordered fashion. However, the optional SuperSort program may be used to extract these names and addresses into a separate data file that may be processed by WordStar.
3. The cursor cannot be moved by a paragraph or page at a time. The movement to the top of a paragraph would be helpful when editing right-hand justified text, which requires additional keystrokes to reformat after insertion or deletion of the paragraph's text. The lack of page movement impedes the editing of long documents.
4. WordStar does not allow the text in memory to be printed. The text must be saved to the disk storage and then may be

printed. This reduces the efficiency when typing "one-shot" memos and letters or text that does not require revision.

5. Because of the backup and work files created during the editing of a document, a document cannot be edited that is greater than approximately 25 pages. This restriction is due to the limited storage of the Osborne disk drive. Upgrading to the double-density disk option permits larger documents to be created and edited.
6. The internal screen of the Osborne computer displays only 52 characters at one time. This limitation reduces operator efficiency when creating and editing wide documents (documents with lines greater than 80 columns).

QUE™
WORD PROCESSOR EVALUATION SCORESHEET
WordStar 2.26 Osborne

	Que™ Score	User Weighting	Weighted Score
APPLICATION FIT	[7]		
1. Memos/Letters	6	____	____
2. Short Documents	7	____	____
3. Medium Documents	8	____	____
4. Financial/Statistics	8	____	____
5. Long Documents	7	____	____
6. Merge-Print Documents	7	____	____
OVERALL FRIENDLINESS	[7]		
1. Installation	8	____	____
2. Entry and Editing	6	____	____
3. Print Formatting	6	____	____
4. Normal Operations	7	____	____
5. Special Operation	8	____	____
EFFICIENCY	[8]		
1. Installation	8	____	____
2. Entry and Editing	8	____	____
3. Error Recovery	8	____	____
DOCUMENTATION	[7]		
1. Screen (self documentation)	7	____	____
2. Manual	7	____	____
3. Reference Card	1	____	____
4. Publisher's Support	8	____	____
FLEXIBILITY	[9]		
1. Transportability	9	____	____
2. Shareability	9	____	____
SECURITY	[1]		
CONTRACT TERMS	[9]		

Rating on 1 to 10 scale
10 is highest rating

QUE™ FUNCTION LIST FOR WORD PROCESSING SOFTWARE

WordStar/MailMerge (Osborne)

		DOCUMENT LENGTH		
Cursor Movement		Short	Medium	Long
up/down/left/right	✓	★	★	★
tab	✓	★	★	★
scroll up/down	✓	★	★	★
jump to marker	✓	◇	□	★
begin/end of text	✓	◇	□	★
word back/forward	✓	□	□	□
sentence back/forward		□	□	□
line back/forward	✓	◇	□	□
block back/forward		◇	◇	★
screen back/forward (vertical scrolling)	✓	◇	◇	★
page back/forward		◇	□	★
Insert				
character		◇	◇	◇
word		□	□	□
line/block	✓	□	□	□
dynamic	✓	★	★	★
open ended	✓	★	★	★
Delete				
character	✓	★	★	★
word	✓	★	★	★
line	✓	□	□	□
to line start	✓	◇	□	□
to line end	✓	□	□	□
block	✓	◇	□	★
all text	✓	◇	◇	◇
Block Operations				
label block beginning	✓	□	□	□
label block end	✓	□	□	□
copy block	✓	◇	□	□
move block	✓	□	★	★
delete block	✓	★	★	★
write block to disk	✓	◇	□	★
limit to block size				

◇ **Convenient** □ **Desirable** ★ **Important**

*** See Footnotes On Page Following Checklist**

QUE™ FUNCTION LIST FOR WORD PROCESSING SOFTWARE

WordStar/MailMerge (Osborne) — Cont.

		DOCUMENT LENGTH		
Search		Short	Medium	Long
once	✓	★	★	★
X times	✓	◇	□	★
all times	✓	◇	□	★
continue	✓	◇	□	★
whole words only	✓	□	□	□
for partial match	✓	◇	□	★
backwards	✓	◇	□	★
with case conversions	✓	◇	□	□
Replace				
once	✓	★	★	★
X times	✓	◇	□	□
all times	✓	□	★	★
continue	✓	◇	□	★
query	✓	★	★	★
On-Screen Appearance				
word wrap	✓	★	★	★
horizontal scrolling	**A**	◇	□	□
text displayed as printed	✓	□	★	★
on-screen help messages	✓	◇	□	★
status line	✓	★	★	★
user tab set	✓	□	★	★
decimal tab	✓	□	★	□
page break displayed	✓	◇	★	★
reverse video	**B**			
size of screen display (typical)	**52 x 21**			
Disk Operations				
disk buffering	✓	◇	◇	★
directory display	✓	★	★	★
rename files	✓	□	□	□
copy files	✓	□	□	□
delete files	✓	★	★	★
revise current file	✓	□	□	□
automatic back-up file made	✓	□	□	□

◇ **Convenient** □ **Desirable** ★ **Important**

*** See Footnotes On Page Following Checklist**

QUE™ FUNCTION LIST FOR WORD PROCESSING SOFTWARE

WordStar/MailMerge (Osborne) — Cont.

		DOCUMENT LENGTH		
Format		Short	Medium	Long
MARGIN SET				
left/right	✓	★	★	★
top	✓	★	★	★
bottom	✓	★	★	★
SPACING				
double	✓	◇	★	□
triple	✓	◇	★	□
incremental	✓	◇	□	★
proportional		◇	◇	□
justified right margin	✓	◇	□	★
line centering	✓	□	★	★
two column		◇	◇	◇
headers	✓	◇	□	★
footers	✓	◇	□	★
footnotes				
page number prefix	✓	◇	□	□
alternating layout	✓	◇	□	★
lines per page	✓	★	★	★
multiple margins	✓	★	★	★
ribbon shift	✓	◇	◇	◇
Print				
underscore	✓	★	★	★
underscore (continuous)				
bold face	✓	□	★	★
overstrike	✓	◇	◇	◇
subscript	✓	◇	★	★
superscript	✓	◇	★	★
special characters	C	◇	◇	◇
partial document	✓	□	□	★
from editor	✓	□	□	◇
text in memory		□	□	◇
Printing Utility				
preview before printing		□	★	★
single sheet feeding	✓	★	□	□
pause during printing	✓	◇	□	□
print multiple copies	✓	◇	◇	◇
simulated spooling	✓	★	□	□

◇ **Convenient** □ **Desirable** ★ **Important**

*** See Footnotes On Page Following Checklist**

QUE™ FUNCTION LIST FOR WORD PROCESSING SOFTWARE

WordStar/MailMerge (Osborne) — Cont.

	DOCUMENT LENGTH		
Merge	Short	Medium	Long
TEXT FILES ✓	◇	□	★
anywhere in file ✓	◇	□	★
DATA FILES ✓	★	□	◇
selection criteria	★	□	◇
from keyboard ✓	□	□	◇
Other			
math mode	◇	★	□
integrated spelling corrector	◇	□	★
program development ✓	—	—	—

◇ **Convenient** □ **Desirable** ★ **Important**

Code Explanations:

end tape

A = Provided by Osborne Computer's hardware.
B = Half-intensity video.
C = WordStar must be configured to print special characters.

SuperCalc

What WordStar is to words, SuperCalc is to numbers. Published by Sorcim Corporation, SuperCalc is a program of a genre called the "electronic spreadsheet."

SuperCalc vs. VisiCalc

Electronic spreadsheets, modeling tools, planning tools, and decision support systems have affected greatly the growth of the microcomputer market. The first major spreadsheet program was VisiCalc, written for the Apple II computer. VisiCalc, created by Software Arts and published by VisiCorp, was the first microcomputer program to be credited with selling over 25,000 Apple computers. VisiCalc was expanded to operate on the TRS-80, Commodore, and Atari™ computers. More recently, the program was rewritten for the IBM Personal Computer. However, a large void still existed because VisiCalc did not run under the CP/M operating system. Those who wished to use a visual planning tool were restricted to using only the four machines on which VisiCalc operated.

SuperCalc is a CP/M version of a spreadsheet program like VisiCalc. A brief discussion of spreadsheets may be helpful to those who have not used a visual planning tool.

Electronic Spreadsheets

An electronic spreadsheet is like a traditional ledger pad. Information is organized into rows and columns. The principal advantage of electronic spreadsheets is that the contents of any location, called a **cell,** can be altered quickly and a new result calculated. Each cell has a name, based on its row and column. The names of other cells can be used in an algebraic formula for calculating the results of a cell. By making the result of one cell part of the calculation for additional cells, projections and totals are quickly determined.

This kind of manipulation provides a hint of the power of the electronic spreadsheet. It helps to organize information; performs the necessary calculations; and permits the operator to add, adjust, or delete information and obtain the result. These capabilities make it

possible to ask "What if...?" By establishing the model and determining the various mathematical formulas for each cell, the operator, asking "what if" questions, can alter the contents of key locations and thereby make projections and forecasts easily.

A SuperCalc Model

The following discussion, which presents one of 21 models provided in Que's *SuperCalc SuperModels for Business* by Douglas Ford Cobb, illustrates the usefulness of the electronic spreadsheet. This particular model is a Loan Payoff Calculator that can determine quickly the balance due on a loan if it is prepaid.

Loan Payoff Calculator

If you decide to pay off a loan early, how do you determine what amount to pay? A simple mathematical technique can answer this question. Known as The Rule of 78s, it has been incorporated into this SuperCalc model.

Principles

Many loans are paid off according to a schedule of uniform monthly payments, each consisting of an interest portion and a principal portion. The interest payment is based on the amount of principal owed and the interest rate on the loan. As the payments progress and the amount of principal owed declines, the interest charges are reduced. This reduction changes the composition of the loan payments. At first, each payment consists of a high interest component and a low principal component because interest is being computed based on the full principal amount. Toward the end of the term of the loan, the composition of the loan payment changes to a low interest component and a high principal component.

For example, consider a $1500 loan with an annual interest rate of 12.75% and 24 monthly payments of $71.14. The first payment includes the interest owed on $1500 for one month. This amount is calculated as one twelfth (or one month's worth) of 12.75% of $1500, or $15.94. The rest of the payment, $55.20, is applied to paying off the principal. The interest component for the next

monthly payment is computed from the reduced principal of $1444.80 (last month's principal, $1500, minus $55.20). Although the payment is still $71.14, more of that amount is applied to reducing the loan's principal and less toward the interest. Each monthly payment of $71.14 consists of a different interest/principal combination because the principal component increases as the interest component decreases.

When you pay off a loan early, you receive an interest rebate from the bank. The amount of the rebate depends on the amount of interest in the remaining monthly payments. Due to the changing composition of the monthly payments, however, it is not easy to determine what part is interest and what part is principal. To solve this problem, use the Rule of 78s formula for calculating the amount of interest in the remaining payments. This amount can then be subtracted from the total of the remaining payments to yield the payment needed to retire the loan early. The Rule of 78s formula for interest rebate is:

$$\frac{(n - k + 1)(n - k)}{n^2 + n} \times \text{total interest cost of loan}$$

where: n = the number of payments in full term

k = the number of payment periods that will have expired when the loan is paid off

The first step in using this formula is to compute the total interest cost of the loan. To do this, multiply the monthly payment amount by the number of original payment periods to determine the total amount that would be paid for the full term of the loan. Then, subtract the principal from the total amount paid to calculate the total interest that would be paid on the loan if all payments were made. For example, in the loan described above, the total amount paid over the term of the loan is $71.14 multiplied by 24 months, or $1707.28. When the $1500 loan is subtracted, the total interest cost of the loan, $207.28, remains.

The next step is to plug this interest cost as well as the other variables into the Rule of 78s equation. Let's assume that 19 payments have been made and that the borrower wants to go ahead and pay off the rest of the loan. Because there is a 24-month payment schedule, "n" in the formula is 24. "K" in the formula is 19,

because 19 payments have been made. Plugging in these numbers gives us the equation:

$$\frac{(24 - 19 + 1)(24 - 19)}{24^2 + 24} \times 207.28$$

The solution to this equation is $10.36, which represents the interest rebate due on the loan. This amount must now be subtracted from the amount we would pay if we were to continue making monthly payments, which is calculated as (24 - 19) x $71.14, or $355.68. Subtracting $10.36 from $355.68 yields $345.32 as the amount needed to pay off the loan after 19 monthly payments.

The Model

The Loan Payoff Calculator has two sections: ASSUMPTIONS and SOLUTIONS. The ASSUMPTIONS section, which begins at cell A10, contains information about the loan being evaluated: the principal amount, annual interest rate, term in months, the number of the last payment made, and the monthly payment amount

The SOLUTIONS section begins at cell A21. Cell F24 contains the calculation for the total amount of interest paid if all payments are made. This amount is computed by multiplying the monthly payment by the term in months:

```
F24 = (F18*F16)-F14
```

Next, cell F26 computes the amount due on the loan by multiplying the number of remaining payments by the monthly payment amount, using the formula:

```
F26 = (F16-F17)*F18
```

Cell F27 uses the Rule of 78s equation to compute the interest component for future payments:

```
F27 = ((F16-F17+1)*(F16-F17))/((F162)+F16)*F24
```

Finally, cell F29 displays the amount needed to pay off the loan, which is computed by subtracting the result in cell F27 from the value in cell F26, using the formula:

```
F29 = F26-F27
```

Using the Model

To use this model, enter the ASSUMPTIONS data and recalculate by typing "!" The amount required to pay off the loan will appear in cell F29. You can save a completed calculation by typing "/S,Filename,A" and print the model by typing "/O,D,A9:H30,P". Note that banks in some states use formulas other than the Rule of 78s to compute loan rebates. Be sure to check with your banker to see if this formula applies in your state.

Modifications

This model is designed to work with any loan that has a uniform series of payments. It can be modified to reflect payments made on a quarterly or annual basis. For a quarterly repayment plan, substitute the quarterly payment amount for the monthly payment amount, then state the term of the loan as well as the number of payments made in quarters. For example, if a loan has a five-year term of which two years have elapsed, then the term of the loan is 20 quarters, and the last payment will be number 8 (2 years times 4 quarters per year).

```
   |   A   ||   B   ||   C   ||   D   ||   E   ||   F   ||   G   ||   H   ||
 1 |=========================================================================
 2 |LOAN REPAYMENT CALCULATOR                    Copyright (C) QUE Corp. 1982
 3 |=========================================================================
 4 |                                 CONTENTS
 5 |
 6 |   1.1 ASSUMPTIONS =>A10                      2.1 SOLUTIONS =>A21
 7 |   3.1 INSTRUCTIONS =>A41
 8 |
 9 |=========================================================================
10 |ASSUMPTIONS                                                  Sheet 1.1
11 |=========================================================================
12 |
13 |
14 |         Principal Amount:                  $  1500.00
15 |         Annual Interest Rate:                    12.75 %
16 |         Term in Months:                             24
17 |         Last Payment Made was Number:               19
18 |         Monthly Payment:                   $     71.14
19 |
20 |
21 |SOLUTIONS                                                    Sheet 2.1
22 |=========================================================================
23 |
24 |         Total Interest Paid at Full Term:  $    207.36
25 |
26 |         Total of Remaining Payments:       $    355.70
27 |         Interest rebate due:               $     10.37
28 |                                              ---------
29 |         Payment required to retire loan:   $    345.33
30 |                                              =========
31 |
32 |
33 |
34 |
35 |
36 |
37 |
38 |
39 |
40 |
41 |INSTRUCTIONS                                                 Sheet 3.1
42 |=========================================================================
43 |
44 |
45 |                  1) Enter ASSUMPTIONS (=>A10).
46 |                  2) RECALCULATE by typing "!".
47 |                  3) SAVE by typing "/S,Filename,A".
48 |                  4) PRINT by typing "/O,D,A9:H30,P".
```

Distinctive Features of SuperCalc

SuperCalc is similar to other popular spreadsheets in that it occupies roughly the same amount of RAM memory, and the commands are similar to those used in most other spreadsheet programs. Therefore, the time required to learn SuperCalc after learning a different spreadsheet method is small.

SuperCalc, however, has several features not found in other spreadsheet programs:

- All, or part, of the model can be saved to disk storage for retrieval later.
- SuperCalc permits easy "global" (entire model) mathematical checking.
- On-screen help is available.
- SuperCalc interacts with WordStar, allowing files saved to disk by SuperCalc to be printed as part of a WordStar document, without reentering the data.

For newcomers to electronic spreadsheets, the *Osborne 1 User's Reference Guide* offers both a tutorial section on the use of SuperCalc and a reference guide from Sorcim with useful suggestions.

It is important to note that SuperCalc is not a substitute for a good general accounting program or some specialized planning programs. However, most people with a reasonable command of mathematics will get excellent results in a short time. If more complex mathematical expressions are required, few of the currently available electronic spreadsheets, such as Microplan™ from Chang Laboratories or MultiPlan™ from Microsoft, can perform these functions. SuperCalc, on the other hand, is sufficiently versatile for most modeling needs.

SuperCalc Commands and Functions

Below is a brief summary of SuperCalc's commands and functions:

Name	Description
/B	Blanks a cell or range of cells
/C	Copies the contents of a range of cells from one location to another
/E	Edits the contents of a cell
/F	Formats the displayed results of a single cell or range of cells, a column, a row, or an entire sheet. The format can be integer numbers, exponential numbers, dollars and cents, graphic characters, or left- or right-justified characters. Changes the column width (0-126), or reformats cell, row, column, or range
/G	Globally sets formats, borders, and tabs; calculates by row or column; calculates automatically (when a change is made) or manually; and controls the automatic advance of the cursor
/I	Inserts a row or column without changing the formula
/M	Moves the contents of the range of cells
/O	Outputs to the printer or a text file (for use with WordStar)
/P	Protects a cell, a column, a row, or a range of cells from content changes
/Q	Quits; returns to CP/M
/R	Replicates: makes a replica of a cell or range of cells
/S	Saves the model to disk
/T	Titles an area. The title does not move as the display scrolls.
/U	Unprotects (opposite of Protect)
/W	Makes a horizontal or vertical window, or both
/X	Execute the program and return to SuperCalc
/Z	Zaps the model: destroys the copy of the model in memory

The following functions are built into SuperCalc:

Function	Description
+	Add
−	Subtract
*	Multiply
/	Divide
^	Raise to a power
=	Equal to
<>	Not equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
ABS(value)	Absolute value
AVERAGE(range)	The arithmetic mean of a range of cells
COUNT(range)	The number of nonblank values in a range of cells
ERROR,NA	Error or not available; normally occurs when a formula uses a cell that is blank
EXP(value)	Raises the number to the given exponent (value)
AND(exp1,exp2)	(exp expression) This is Boolean algebraic logic. Returns a 1 (representing a true condition) if the two expressions are nonzero; otherwise returns a 0 (false)
OR(exp1,exp2)	If either expression is true (non-zero), it returns a true value (1); otherwise, a false value (0)
NOT(expression)	Returns a value of 1 if true, but 0 if false
IF(exp1,exp2,exp3)	When expression 1 is true (And, Or, and Not logic may be used), then use exp2; otherwise, use exp3

INT(value)	Return the truncated, integer part of the number
LOOKUP(value, column/row range)	This searches a range of values in ascending order and returns a number in the column immediately to the right of the number less than or equal to the searching number. Used frequently for tax tables, factoring tables, etc.
LN(value)	Returns natural log of the value
LOG10(value)	Returns log base 10 of value
NPV(discount, column/row range)	Returns net present value at the discount rate
PI	PI at 16 significant digits
SIN(value)	Sine (trig calculation of the value in radians)
ASIN(value)	Arc sine
COS(value)	Cosine
ACOS(value)	Arc cosine
TAN(value)	Tangent
ATAN(value)	Arc tangent
SQRT(value)	Square root
SUM(list)	Returns the sum of a list or a range of cells

A more detailed discussion of SuperCalc and examples of its use may be found in QUE's *SuperCalc SuperModels for Business* by Douglas Ford Cobb.

Chapter 6
The Osborne Software Library

The Osborne Computer Corporation offers a cross section of popular, repackaged software titles through its dealer distribution network. These software programs, or "tools," extend the power of the computer system. Where necessary, the programs have been modified for optimal use on the Osborne 1 computer.

Some of the available supplemental programs are extensions or "enhancements" of the supplied software package. The largest single category of supplemental programs is word-processing, including spelling checking, indexing, and auxiliary tools. The rest of the optional software consists of operating systems, system utilities, programming languages, and application programs.

CP/M computers like the Osborne 1 rely on an extensive software base. In fact, the size of this base is so great that many microcomputer dealers cannot stock all of the popular software. OCC's Approved Software list gives the Osborne dealer a manageable way of obtaining sound, popular programs through established distribution channels.

The list of software programs in this chapter is far from complete. Bob Moody, manager of the Osborne Approved Software program, states that by the end of 1982 the library will consist of over 70 programs. More than 200 Osborne-approved programs will be available by the end of 1983. OCC is adding between 10 and 15

new titles to the library each month. An Osborne dealer should be consulted for current information on the software library.

The software programs listed below are divided into three major areas: operating system and utility software, programming languages and related software, and applications programs. The original author, city and state, and a brief description are provided for each program. Pricing information is in Chapter 8.

Operating System and Utility Software

Software is available for operating systems and system utilities.

Operating Systems

An operating system that is gaining in popularity is the UCSD p-System.

p-System

Creator: *SofTech Microsystems, Inc.*
San Diego, California

The UCSD p-System is available in two forms: the run-time package and the full p-System. The "p" in p-System comes from the semimachine-language code (pseudo instructions or P-code) that is produced. The p-System provides unrivaled program transportability. Programs developed on one computer equipped with the p-System may be used on any similarly equipped computer. The run-time package, provided at no additional charge when Osborne owners purchase the double-density disk drive option, allows the Osborne owner to execute any program written under the p-System, provided that it is supplied on a disk format compatible with the Osborne 1.

The p-System offers four UCSD languages: the widely popular Pascal programming language; a version of the American National Standards Institute 1977 standard for the FORTRAN programming language; a compiled version of BASIC; and macro assembly language programming. Program development under any of these languages is contingent on the purchase of the p-System's program-development system.

The Pascal language is popular in both the educational and system development areas. For educational purposes, Pascal is the easiest structured programming language to learn. The skills developed in using Pascal can be transported to other structured languages, such as FORTRAN, C, or COBOL. For the system developer, Pascal permits the rapid development of system utilities and other languages. Almost 95% of the p-System is written in Pascal; the UCSD FORTRAN and BASIC languages are also written in Pascal.

The UCSD p-System is an excellent addition to the software library.

System Utilities

Two problems strike all users of floppy diskettes: the loss of essential formatting information due to disk drive malfunction, and the physical wear of the diskette's magnetic oxide. Either problem can cause a "BDOS ERROR on A: Bad Sector" message. When this message is displayed by the CP/M operating system, information on the diskette is probably lost.

A third problem faced by computer users is an inadvertently erased file. Once a file is erased, its contents are usually lost.

Disk Doctor™

Creator: *SuperSoft Associates*
Champaign, Illinois

Disk Doctor is a friendly, menu-driven disk utility program. Its three major purposes are to recover erased files, to recover a disk with bad sectors, and to "erase" (hide) bad disk sectors.

The first part of the Disk Doctor program helps the operator recover a file that has recently been erased, by copying any "recoverable" erased files to another floppy diskette. This process is not effective if the diskette containing the erased files is used before running the program.

The second section of the program transfers information from a file containing one or more bad sectors to another disk. Depending on the location of the bad sectors, it may be difficult, using conventional means, to recover the contents of a file. Disk Doctor recovers as much of a file's contents as possible.

The last utility hides any bad sectors on a disk by grouping them in a file called Morgue. Once the bad sectors are identified, the rest of the disk can be used freely.

Disk Doctor is a valuable utility. Its use can salvage normally unrecoverable files and prevent the loss of work.

SuperSort™

Creator: *MicroPro International Corporation*
San Rafael, California

SuperSort is a disk file utility for sorting and merging data files. Its operations are exceptionally quick and vastly superior to sorting programs written in BASIC or other high-level languages. SuperSort is compatible with many different languages, but it can also be used as a stand-alone utility program. Sections of a file may be extracted (selected) or excluded from the sorting process, permitting the creation of specialized lists, such as name and address lists or overdue accounts.

SuperSort is a worthwhile utility that is used most often with other programs, such as DataStar™ (MicroPro's data entry program), WordStar, or other products that produce data files.

Programming Languages and Related Software

Programming languages and related software add versatility to the Osborne 1.

Programming Languages

FORTH is a high-level compiled computer language with a fully interactive screen editor.

FORTH™

Creator: *Software Works*
San Diego, California

FORTH has won acceptance in process and device monitoring, and also in control applications. When coupled with the Osborne 1's IEEE-488, FORTH may be used for program development.

Software Works, the author of this descendant of fig-FORTH, claims conformity to most of the FORTH-79 standard.

Microsoft BASIC-80 Compiler™

Creator: *Microsoft, Inc.*
Bellevue, Washington

BASCOM is the compiler version of the BASIC-80 programming language. The BASIC-80 compiler can be used with the BASIC-80 interpreter supplied with the Osborne 1. Two advantages of compiled BASIC programs are faster program execution and program security.

BASCOM accepts a BASIC program written under the interpreter version that has been saved as an ASCII file by the ",A" option. The program is then translated into machine-language instructions that are assembled, linked, and executed. This method offers an ideal environment for program development. Programs can be written, tested, and debugged under interpretive BASIC, then transformed into a CPU-executable program (.COM file) by BASCOM. Most interpreted BASIC-80 can be compiled without any change to the program.

The BASIC-80 compiler is beneficial to programmers, but is less useful to nontechnical computer operators.

Program Generators

Personal PEARL is a program generator, a program used to generate other programs.

Personal PEARL™

Creator: *Relational Systems International Corporation Salem, Oregon*

This spin-off of PEARL, a program generator for business and commercial applications, is designed with the novice in mind. Personal PEARL uses a series of menus and prompts to develop a CBASIC program that contains the necessary operator prompting for information, error checking, and routines for recording and retrieving information from the floppy disks. A flexible report formatter for hard copy is also provided.

Personal PEARL produces CBASIC source programs, the humanly readable instructions that are transformed by the CBASIC compiler into computer executable programs. The programs produced by Personal PEARL may be modified. A working knowledge of CBASIC is required for this customization.

Applications Programs

Available applications software enables Osborne owners to perform many useful tasks without having to develop programming skills.

Accounting

Designed for use by fraternal organizations, clubs, sole proprietors, small businesses, and families, Money Maestro is a friendly, single-entry bookkeeping system.

Money Maestro™

Creator: *Innosys Incorporated Berkeley, California*

Money Maestro is a personal/home finance manager. After payee lists, categories, and projected budgets are established by the user, groups of bills can be entered into the system. The system will then report on outlay by category or by payee for actual or budget outlays, and will compare actual versus budgeted funds. Custom reporting for tax purposes is provided by the system, and all reports and lists may be adjusted by using simple, English-like commands.

Money Maestro contains a practice feature with "dummy" data so that the operator can experiment with the program without affecting live data.

Communications

BSTAM, a popular telecommunications utility program for CP/M-based computers, transfers program and data files between two BSTAM-equipped computer systems.

BSTAM™

Creator: *Byrom Software*
Bernel, Utah

Extensive error checking and correction are used to insure integrity during operations. BSTAM is ideal for transferring programs or text between the Osborne 1 and another similarly equipped computer system.

In its native form, BSTAM requires a special assembly language program to customize it to a computer's hardware. This customization has been performed by OCC.

Data Management

There are three data-management programs currently available for the Osborne 1.

DataStar™

Creator: *MicroPro International Corporation*
San Rafael, California

Published by the same firm as WordStar, DataStar is designed for the development of standard data entry formats, such as registration forms, invoices, etc. This program also has built-in math computation. Information can be retrieved by attribute and/or batch.

DataStar writes its information to diskette in a format that is transferable to SuperSort, WordStar/MailMerge, and others.

dBase II™

Creator: *Ashton-Tate*
Culver City, California

dBASE II is a popular relational data base management program that uses an easy-to-grasp, COBOL-like programming language. The program supports 65,000 records with 32 fields per record and 256 characters per field. dBase II's indexing scheme accesses "key" information in less than two seconds. Nonprogrammers can quickly work at the dBASE command level for creating and running reports and analyzing information.

The program comes with several sample data bases and programs. ZIP, a screen-generator, and extensive documentation are also included.

Because of the nature of the Osborne 1 disk drives, double-density drives are recommended for use with dBase, and hard disk storage is preferred.

Filefax™

Creator: *TMQ Software*
Des Plaines, Illinois

Filefax is a data base management system, not a data base manager. This electronic filing system is one of three such programs offered by Osborne. Filefax allows the user to make formats and design the reports that will be used with the data.

Planning and Scheduling

Analyzing plans and scheduling appointments are functions of the following programs.

Milestone™

Creator: *Organic Software*
Rosedille, California

Milestone is a critical-path planning tool. Critical-path analysis is a method of taking a large project and dividing it into smaller tasks. The term "critical" stems from a job that, if delayed, delays an entire project.

The Milestone program creates Gant project charts and allows for critical-path projection. Approximately 125 activities (tasks) and nine manpower levels can be manipulated for a project. The time units used in planning may be hours, days, weeks, months, quarters, or fiscal quarters. Provisions have been made for holidays, both standard and user-specified.

This program is intended for managers, contractors, engineers, and other personnel involved in project management and project quotation.

Personal Datebook

Creator: *Organic Software*
Rosedille, California

Personal Datebook is an abridged version of Datebook II and schedules appointments for up to 4 professionals (Datebook II can schedule for 24). Personal Datebook maintains up to 3 months of appointments. The period between appointments can be established between 6 and 30 minutes within a 12-hour work day. Also, the user can set the starting time for this 12-hour day. Each entry for an appointment contains the visitor's name and the reason for the visit. A day-at-a-glance listing may be printed, detailing any day's appointment information.

The program, which is friendly, menu-driven, and easy to use by both professionals and clerical people, is recommended for small offices or professionals who schedule many appointments each workday.

Word Processing

Many programs are available to help process and manage text. These programs include:

Enumerate™

Creator: *Orthocode Corporation*
Albany, California

Enumerate is an auxiliary tool for WordStar and prints a WordStar text file, prefixing each line with a line number. Enumerate can be used for manuscripts and contracts. It is particularly useful in legal work, where line-numbered documents are used extensively.

Documate™

Creator: *Orthocode Corporation*
Albany, California

Although it is called "Documate" by OCC, this program is the second generation of the Documate/Plus program. Documate/Plus

uses commands, ignored by WordStar's printing program, that are embedded in WordStar text files. From these embedded commands, a table of contents and an index are generated. Both the table of contents and the index can have eight levels of indentation. In addition to normal entries in the index, **See** and **See also** entries may be created.

A unique feature of Documate/Plus is its ability to generate "intermediate" index files that are combined later to make the document index. This feature is helpful in computer systems with limited memory, or, like the Osborne 1, with limited disk storage.

Documate/Plus is recommended for students, writers, and authors who create manuals, documents, or manuscripts of some length.

Footnote™

Creator: *Pro/Tem Software, Inc.*
Stanford, California

The **Footnote** program uses the WordStar editor to embed commands. The actual footnote is placed in a paragraph or in a separate text file. Then the document is saved, and the Footnote program is executed. Footnote finds the reference, adjusts the text and places the footnote at the bottom of the page. Each footnote is numbered automatically. After the Footnote program is finished, the document may be printed, using WordStar. If the document is edited, or sections of text are inserted or deleted, Footnote can be rerun to adjust the footnotes on the edited document.

Footnote can be useful in both the academic and legal fields, in which footnote documentation is commonplace.

Grammatik™

Creator: *Aspen Software Company*
Tijeras, New Mexico

The advertisement states that Grammatik "goes beyond spelling checkers." This statement is correct. Grammatik is not just a spelling checker/corrector; it is a unique word-processing tool that analyzes the grammar and structure of a document. (It resembles the powerful Writer's Workbench available on the Unix operating system.)

Grammatik reads and compares a document against a phrase dictionary that contains examples of poor usage and grammatically suspect phrases. It then reports the use of these phrases with suggestions for correction. In addition, Grammatik marks double words (e.g., "the the"), incorrect capitalization, and other common errors. It analyzes documents for word occurrence, prepositions, shortest and longest sentences, average sentence length, and other statistics. An additional program, PROFILE, groups and reports by frequency all words used in a document.

Like spelling checker/correctors, Grammatik does not replace the need for human proofreading, but does aid significantly in the process of perfecting documents. Grammatik is a powerful tool that is recommended for writers who require suggestions and help with the grammar and style of their documents.

Mailman™

Creator: *Standard Microsystems*
Langhorne, Pennsylvania

Designed to work with WordStar/MailMerge, Mailman is a program that allows different selection criteria for sending form letters. As its name implies, Mailman is designed to keep mailing lists.

MATH*™

Creator: *Force Two, Inc.*
McLean, Virginia

MATH* is an enhancement to WordStar that allows math computation to take place while a document is being edited. Although MATH* is not a substitute for SuperCalc, the program provides useful addition, subtraction, multiplication, and division functions.

Because it is installed into WordStar, MATH* commands can be used while editing is taking place. MATH* will manipulate a line, a column of numbers, or formulas shown on the video display. The result of the program is placed in the document's text.

This program is useful for developing contracts, quotations, statements, and other financial or mathematical documents.

Spellguard™

Creator: *Sorcim Corporation*
Santa Clara, California

Spellguard is a literal spelling checker program that was originally written and marketed by Innovative Applications, now part of Sorcim. Spellguard uses a 20,000+ word dictionary to check rapidly a document's text. If a word appears in the document that does not appear in the dictionary, the word may be added to the dictionary, ignored, or marked in the text of the document.

One major feature of Spellguard 2.0 is a compressed word dictionary. The 20,000+ word dictionary, which normally would require over 100K of disk space, occupies only slightly more than 50K. This feature is particularly beneficial to Osborne 1 owners with the sing-

le-density disk drive because the Spellguard program and dictionary can be stored on one diskette.

In view of the program's speed, compactness, and ease of use, Spellguard is recommended to any word-processing user requiring documents free of typographical and spelling errors.

The Future of Software

The Osborne Computer Corporation's commitment to growth assures that the Osborne software library will continue to grow. Its projected 200+ titles by the end of 1983 should offer the Osborne 1 owner an excellent cross section of capable microcomputer programs.

The Osborne 1 appears to be complete in its operating systems. The Osborne 1 uses the Z80 microprocessor and the two most significant operating systems, CP/M and the UCSD p-System, to fulfill most owners' requirements. The use of CP/M makes a wealth of prewritten, highly compatible software available to the Osborne 1 owner. The p-System gives the owner even more portability than CP/M because the p-System can run on more dissimilar computer systems than CP/M and removes the requirement for a different operating system.

The Osborne 1 computer will undoubtedly offer more planning tools. Because both Microsoft and Digital Research are closely tied to OCC, their languages will probably become available for the Osborne 1. Perhaps the key to the availability of these languages is the double-density option for the Osborne 1 disk drives. Two 92K disk drives are insufficient storage for some computer languages. Therefore, an Osborne 1 owner who wishes to use a particular language may have to upgrade storage capability by acquiring double-density drives as they become available.

Microsoft, the author of BASIC-80 and BASCOM, offers Pascal, FORTRAN-66, and COBOL for CP/M-based systems. Each language, except the interpretive BASIC-80, is implemented by Microsoft's M80 and L80, the 8080/Z80 macro assembler and linker. These two powerful tools for machine-language programming may be offered separately for those wishing to write assembly language programs.

Digital Research, the publisher of CP/M, offers a wide range of programming languages and tools. For the assembly language programmer, Digital Research offers MAC, its macro assembler. SID/ZSID are the Symbolic Instruction Debuggers for the 8080 (SID) and Z80 (ZSID), a powerful superset of CP/M's DDT package. Through its acquisition of Digital Microsystems in 1980, Digital Research can offer the Pascal/MT+ language and the Speed Programming Package, a set of Pascal/MT+ development aids. CB-80, the true CBASIC compiler that does fast-executing BASIC programs, is also available. In addition, Digital Research has two COBOL programming languages from MicroFocus in England: CIS COBOL, a certified low-to-intermediate compiler; and Level II, the only microcomputer COBOL that has a GSA (Government Services Accounting)-certified high compiler.

Display Manager and Access Manager are two new programming tools available from Digital Research. Both tools are program generators. Display Manager creates a formatted video screen for the display, input, and output of information for a program. Access Manager is a file handler, handling the input and output of single keyed files. Both products are good programmer productivity aids, but are not suitable for the casual programmer.

Most of the programming languages from Microsoft and Digital Research, mentioned above, benefit from, or require, the double-density disk option. The use of COBOL, a language that traditionally requires large amounts of disk storage, on the diskette drive-based Osborne 1 may also be counter productive.

The inclusion of the FORTH programming language signals that OCC is striving to bring less dominant languages to the Osborne 1 computer owner. It would be appropriate to expect programming languages such as C, Logo, and others to be found in the Osborne-approved library by the end of 1983. The number of applications programs should also increase during the next two years.

The only accounting program currently offered by OCC is Money Maestro, a single-entry accounting system. As disk storage increases, Osborne Computer will add more accounting programs to the software library. It is doubtful that the number of communications programs will grow, because OCC offers its own excellent software package with the Osborne modem.

Three rapid growth areas will be entertainment, education, and personal productivity tools. Whereas CP/M is not highly regarded for its educational or entertainment programs, this area is now showing signs of expansion. The unfriendliness of CP/M and the lack of graphics were the major stumbling blocks. The development of the AUTOST program, which provides self-starting computing, can conquer the unfriendliness of CP/M. Although the use of color graphics is impossible, the Osborne provides graphic characters with its monochrome display. Both features can be used in the educational and entertainment areas.

The education market is divided into three areas: computer literacy/programming, interactive training, and computer-assisted instruction (CAI). The price and size of the Osborne 1 are ideal for the first area, teaching computer literacy and programming. The second area of education is industrial/commercial. Many companies offer sets of programs to teach the use of other computer programs. Known as interactive training, programs in this area offer unique, hands-on tutorials for programs like BASIC-80, WordStar, and SuperCalc. These programs address a need in the commercial market to train quickly an operator in the use of a selected program.

The third area, computer-assisted instruction (also known as computer-assisted tutorials, CAT), is usually associated with elementary and secondary education. CAI programs are used to supplement or expand classroom work. Traditionally, CAI has been popular on computers with color graphics, such as the Apple. Recent movements in CAI, however, indicate that noncolor graphic, but cost-effective, computers like the Osborne are gaining in popularity. The Osborne library plans to feature some of these educational programs in the future.

Other applications areas of potential growth are word processing and planning. OCC has started work on packaging a series of word-processing tools in one set for an attractive price. Such efforts will continue.

The Osborne 1 owner is not restricted to only Osborne-approved software. Many other programs can be purchased on Osborne 1-compatible diskettes. However, the Osborne 1 owner may have to contact the program's publisher or distributor directly to obtain a

particular program because local Osborne dealers cannot carry every program that is compatible with the Osborne 1 computer.

In keeping with cost-effectiveness and simplicity, the Osborne Approved Software library makes many fine programs available to the Osborne 1 owner through local computer dealers. With OCC's ambitious plan to bring more than 200 programs into the library by the end of 1983, the Osborne 1 owner should keep in touch with local Osborne dealers for the latest information on additions to the software library.

Chapter 7
Telecommunications

One of the fastest growing industries today is the gathering, processing, and sending of information. In fact, the 1980s have been declared the information age.

Computer prices have declined as rapidly as computing power has increased. Professionals, small businesses, and households have computer systems that are more powerful than ones the largest corporations could afford 10 years ago. This increase in computer power allows both corporations and households to take advantage of the many developments in the handling of information.

"Telecommunication" means communication at a distance. The computer is a communicator that can serve as an instant connection to information sources throughout the world. This "instant" connection is an exciting prospect for Osborne 1 owners because a computer that travels can converse with home or office computers, university computers, information services computers, or a distant friend who also owns a microcomputer. IBM predicts that more than 85 percent of computer equipment will be involved in communications in the next 5 to 10 years.

Computer communications serve many purposes. One popular form is "electronic mail." Another area, bank-by-phone, allows cash transfers, transaction inquiries, investment information, and other services through computer-telephone communication. Time-sharing networks provide both information and convenience services, such as airline reservations and shop-by-computer services.

Immediacy is the prime advantage of communicating with the computer. Calls are not put on hold; reports can be located in seconds; and, in minutes, 30 letters can be sent to electronic mailboxes thousands of miles away.

The computer can also be used to analyze or manipulate received information. For example, WordStar can re-edit, compose, merge, or copy information received by telephone modem. Suitably formatted information can be processed by SuperCalc, and information received can be stored in a data base file for later manipulation.

Methods of Communication

Computers can communicate in several ways. The Osborne 1 usually converses with other computers over telephone lines. However, the Osborne 1 can be wired to most other computers, regardless of manufacturer and operating system. When two or more computers are connected, information can be exchanged. The decision of whether to link the computer by a direct connection or through telephone lines depends on the task, distance, and speed required.

There are five common forms of communications used by the Osborne 1 computer.

The Osborne 1 to Mini-/Mainframe Computers

Before 1980 mainframe computers and minicomputers, with their large storage areas and strong computing power, were the dominant computer workhorses. Most microcomputers were used as dumb terminals, and their power was limited to displaying information from the host computer. Although the practice of using microcomputers merely to display information is still popular, larger companies have begun using microcomputers as intelligent terminals.

The microcomputer can be connected to the host computer by a modem. Sophisticated communications packages allow the microcomputer to store information transmitted from the mainframe computer. Once this information has been "downloaded" into the microcomputer, the information can be examined, edited, analyzed, transmitted back to the mainframe, or disregarded. Because the heavily used mainframe computer is often tied up, reducing the

amount of response time, the microcomputer is becoming popular with mainframe programmers, student programmers, and computer auditors. After the necessary work has been performed, programs and information can be "uploaded" back to the host system.

The microcomputer is also a sophisticated key punch machine that can be used by departments within a company for data entry. After information is accumulated, it can be uploaded into the host computer for processing.

Some companies see the portable computer as the ultimate sales companion. With custom communication packages and the portable computer, the salesperson can accept orders in the field. The Osborne 1 can function as a remote inquiry/sales order terminal, giving the salesperson the latest pricing and lead-time information at any time and wherever there is a telephone—even at the customer site. Using specialized programs, the salesperson can transmit an order to the company's host computer for immediate processing.

The Osborne 1 and Public Information Networks

The Osborne computer can be connected to several public information networks through telephone lines. Three subscription networks are available: the Dow Jones News/Retrieval Service, The Source, and Compuserve. These networks are professional-/consumer-oriented, time-sharing services.

In many American cities, dialing a local telephone number will give the user access to a network. **Tymnet** and **Telenet,** two telecommunications networking services, provide this local service. A modem or acoustic coupler and proper communications software are needed for the Osborne 1 to tap these networks.

Dow Jones News/Retrieval Service

Dow Jones & Company, Inc., publisher of the *Wall Street Journal,* also operates a computer service company, the Dow Jones News/Retrieval Service. This service offers two levels of subscriber service. The full service has information on business and related news; stock, bond, commodity, and option price information; corporate financial statistics; and economic forecasts. Investors appreciate the speed with which this reliable information is transmitted. The

second level of service provides current stock, bond, and commodity prices after a 15-minute delay. Microcomputer owners with stock or bond portfolios use the service to download current prices and perform history and movement analysis on the microcomputer.

The Source

Formed in 1979, The Source (Source Telecomputing Corporation) was purchased by *Reader's Digest* in late 1980. Living up to its motto, "America's Information Utility," The Source offers a staggering amount of information, including stock and bond quotations, portfolio analysis, electronic mail, UPI news, entertainment, games, programming, and information storage. Enormous data bases are available to the user, including the *New York Times Magazine* and UPI (United Press International) News, which hold information on thousands of topics. Many data bases may be searched by topic or key word. In addition, shopping services, airline schedule inquiries, and orders may be placed on The Source.

Traditional programming services, ranging from statistical to entertainment, are also available. These services may use high-level languages or existing programs. With The Source, the user can even purchase computer programs over the network. The purchased programs are downloaded into the computer system.

Available through microcomputer dealers or its McLean, Virginia offices, The Source is a local telephone call in over 400 cities around the world. In Alaska, The Source is available as an IN WATTS (800 toll-free) number. The Source plans to offer the computer equivalent of the conference call by linking up several computers simultaneously.

The initial fee for The Source is $100. Then, a minimum charge of $10 per month is deducted from the purchaser's charge card, unless company billing is arranged. If the user is dissatisfied for any reason, The Source offers a money-back guarantee.

CompuServe

CompuServe Information Services (formerly MicroNet), a subsidiary of CompuServe Inc., is one of the world's largest time-sharing networks. This Cincinnati-based company offers services similar to

The Source. However, CompuServe uses the Associated Press wire service and offers Standard and Poor's information data base.

CompuServe is the only network that has bank-at-home services, such as bill paying and transfer of funds. This service, supplied by the United American Banks in Knoxville and Memphis, Tennessee, can be used throughout the CompuServe network.

CompuServe is available only through Radio Shack. The retail price of $19.95 for a terminal, or $29.95 for a computer like the Osborne, includes some software. The Dow Jones service, purchased though computer stores, can be used without the software program. Although an official version has not been released for the Osborne 1, one is expected soon.

The Source and CompuServe both have electronic mail and bulletin board services for subscribers. Bulletin boards can be established on many topics. Subscribers send messages to one another, using a password or user identification number to assure privacy.

Information Service Rates

	Hourly Charges($)			
	The Source		CompuServe	
Baud rate	300	1200	300	1200
Prime time	20.75	29.75	22.50	35.00
Evenings and weekends	7.75	14.75	5.00	17.50
After midnight	5.75	9.75	5.00	17.50

All three services may be used with 300 baud (300 bits per second, or 30 characters per second) modems or acoustic couplers. Available also are 1200 baud (120 character per second) hookups at a higher rate.

The Osborne 1 and Other Information Services

The Osborne 1 can use selective data base services for communications. Like the Dow Jones News/Retrieval Service, The Source, and CompuServe, these networks provide information by subscription. Many networks use Telenet and Tymnet for local area access. The specialized, commercially based information these net-

works offer differs from the more consumer-based information available from The Source and CompuServe.

The resources of selective data base services help subscribers make decisions. Although each data base is usually specialized for a specific industry, some of the larger data bases have become diversified to appeal to a wider market.

Data bases are often used for bibliographic research. Two such data bases are **Stairs**™, a network offered by IBM, and System Data Service's **Orbit**™.

The largest data base service available, **Dialogue**™, contains information on more than 100 different subjects, including science, engineering, business, economics, and languages. Dialogue, managed by Lockheed Corporation in California, has wide appeal.

The popular data base from West Publishing, **Westlaw,** is available through Telenet/Tymnet. Westlaw's data base contains information for attorneys and other legal professionals.

Meade Data Central's **LEXIS** is the most extensive, full-text legal data base offered. **NEXIS,** also from Meade, is a full-text news data base.

The National Library of Medicine offers two data bases: **MEDLARS,** with Index Medicus, and **ELHILL**.

Further information on these data bases is available from:

Information Industry Association
316 Pennsylvania Avenue S.E., Suite 400
Washington, D.C. 20003
(202) 544-1969

For customers with large accounts, banks and financial institutions provide access to information through terminals or microcomputers like the Osborne 1. Several service companies offer microcomputer communications, including Automatic Data Processing's Network Services Division, National Data, and Anacomp.

The Osborne 1 requires a 300-baud modem or acoustic coupler and terminal software for communication with information services. Most services also offer 1200 baud for a higher fee.

The Osborne 1 and Local Bulletin Boards

The most inexpensive telecommunications method is community bulletin boards because they are funded through computer hobbyist or interest groups. Some bulletin board systems can be entered only with an assigned password. These systems usually operate at 300 baud and use no communications protocol to assure accurate transmission.

Bulletin boards are public message centers and information pools. Tips on using the computer, local computer gossip, and special interest messages will often appear on the bulletin board.

When operated by a computer store, a bulletin board will let an order be placed and then billed on a major credit card. Bulletin boards that are operated by a club usually specialize in one manufacturer or operating system, such as Apple or CP/M. With the right software, programs may be downloaded from the bulletin board into the Osborne 1 and used immediately.

There are some drawbacks to community bulletin boards because they are not operated professionally or for profit. Only one computer at a time can access a bulletin board; and the user may have to wait several hours to be connected with popular bulletin boards. Most bulletin boards are operated on computers owned by individuals. When the individual needs to use the computer, the bulletin board is out-of-service during that period. Because bulletin boards do not use sophisticated protocols to assure accurate data transmission, garbled information may be displayed on the screen during bulletin board calls.

Despite these shortcomings, the popularity of community bulletin boards is increasing. Information about them can be obtained by contacting a local computer dealer or club, time-sharing networks like The Source and CompuServe, or bulletin boards themselves. An extensive listing is available from:

People's Message System
Santee, California
(714) 561-7277
24 hours operations/300 baud

The Osborne 1 and Other Microcomputers

The Osborne's portability is ideal for work on the road. The busy professional or executive can compose memos or letters with WordStar. SuperCalc can be used in the office, motel room, or home for planning. Once a document or model is created or perfected, it can be printed.

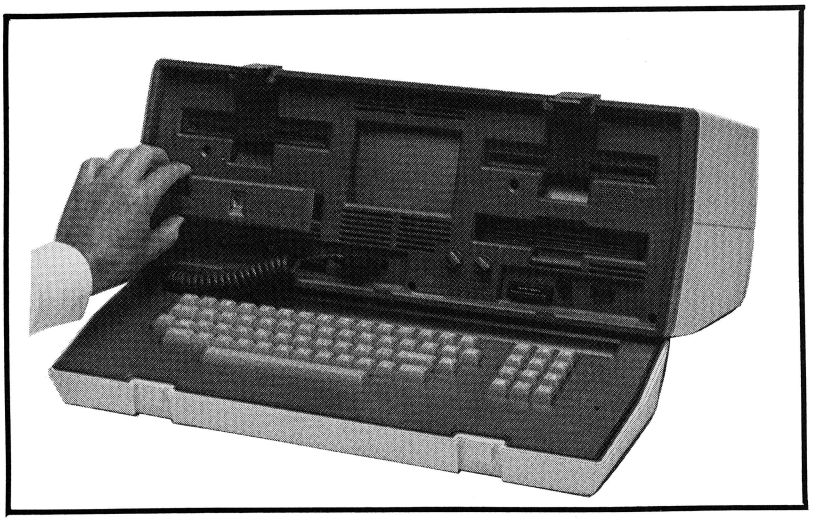
Compatible computers should be used to share information and programs. In some cases, a generated document may be moved to another microcomputer system for printing, storing, and later use. For example, this book was originally created on the Osborne 1, then moved to another computer system for final production. Because of this kind of shareability, a user can work on a CP/M-based computer system at the office, transfer the information to the Osborne 1 to complete at home or on the road, then put the information back in the office's computer in the morning.

CP/M-based programs that are not published for the Osborne 1 can also be shared. These programs may be downloaded into the portable computer for use at home or on the road.

Document transfer can be made if the Osborne 1 and another computer have a common communications line. This line may be established by modems and telephone lines or by directly connecting with a suitable cable both computers' RS-232 serial ports. Also, software is needed to perform the transfer and to insure that no information is lost while the transfer is taking place.

One program for transferring, BSTAM, is available through the distribution network for the Osborne 1.

BSTAM must be used by both computers for telecommunication to take place. A product of Byrom Software, BSTAM offers complete error checking (verification) and is written for many CP/M microcomputers. Direct communication from one microcomputer to another is supported by serial cables in several modes.



The Osborne modem being installed into the left floppy diskette pocket. (Photo courtesy of Osborne Computer Corporation.)

Technical Concepts of Intercomputer Communications

Generally, both computers must be in technological agreement before communications can take place. Many factors governing the characteristics of the transmission and reception of data must be identical on both computer systems.

For example, character sets, number of data bits, duplex (half or full), speed, parity, and handshaking and error detection/correction must be the same on both systems.

Hardware, the RS-232 (modem) port and a modem or acoustic coupler, and appropriate software are also necessary for successful communications.

ASCII Characters

The formation of characters can be done with one of two character sets. The Osborne 1 "speaks" in the character set used by most

microcomputer systems — ASCII (American Standard Code for Information Interchange). IBM's proprietary character set is EBCDIC (pronounced eb-SEE-dick), or Extended Binary Coded Decimal Interchange Code.

Each character set uses the 8 different bits in a byte to form a single character. However, the two character sets are incompatible. The set of on-and-off bits that represent the letter "Y" to an EBCDIC-speaking computer represent "D" to an ASCII-speaking computer. Therefore, extensive software or hardware converters must be bought before a computer can speak another character code.

When the Osborne 1 communicates with a mainframe computer, the mainframe must understand the ASCII character set. Therefore, most Osborne 1 computers cannot directly communicate with IBM equipment, unless one computer converts to the native character set of the other.

Each ASCII character sent by the Osborne may be 7 or 8 bits long. Although a computer "thinks" in 8-bit groups (bytes), the major ASCII standard applies to the first 7 bits of the character (known as **data bits**). Therefore, textual characters can be transmitted in either 7 or 8 bits. To signal the start of a character, one additional bit (a start bit) is added to the front of the character. One or two stop bits are added to the end of a character. These start and stop bits help the receiving computer "frame," or form, the received character. The average total length of each character is 10 bits: 1 start bit, 1 stop bit, and 8 data bits.

The term "baud" is often used to mean "bits per second." A 300-baud modem transmits 30 characters per second (300 bits/10 bits per character), and a 1200-baud modem transmits 120 characters per second. Dividing by ten will change baud to characters per second.

Protocols

Protocols are rules that apply to the interchange of information between computers. Newcomers are often confused by the term "protocol" because of its different meanings that arise from the several different levels of protocols in computer communication.

The first level is based on the composition of the transmitted character. When both computers speak the same character set, each must know the length of the character (number of start, stop, and data bits) and the speed of transmission (baud or bits per second). Once these are established, the two computers can transmit and receive characters.

The second level is based on **parity checking,** a method of checking for errors in the transmission of a character. Each bit in a character is either a one or a zero. The number of ones in the data bit is totaled. Then, based on this sum, a parity bit is added to the end of a character and placed before the stop bit(s). With odd parity, the parity bit is set so that the total number of ones in the transmitted character is odd. When the parity is even, the parity bit is added so that the number of ones in the character is even. "No parity" means that a parity character was not added.

Two other parity protocols, mark and space, may also be used. With **mark parity,** the parity bit is always 1. **Space parity** forces the parity bit to 0. The parity bit for each character is frozen as either 1 or 0 with these protocols, meaning, essentially, that it is not used.

The 8th bit of a character is sometimes called the **parity bit,** because it was routinely used for parity checking in the past. This protocol is excellent for the transmission of text because the standard ASCII 128-character set may be transmitted in 7 bits. However, some programs use all 8 bits. WordStar, for example, uses the eighth bit, making impossible its use for parity. For this reason, the most popular form of parity on microcomputers is none. As a result, the transmission of characters is unprotected and has no form of checking for errors.

Information is transmitted with either a half-duplex or full- duplex protocol. The **half-duplex** method sends information down the circuit (usually the telephone line) in one direction at a time (simplex). Because half duplex requires only one circuit for operation, this method has the limitation of allowing only one computer at a time to "talk." The **full-duplex** protocol, on the other hand, allows simultaneous (bidirectional) transmission.

Both computers can send and receive information at the same time. Although most communications software packages for the Osborne

1 allow for either method, most 300-baud communications are in full duplex. In the past, 1200-baud modems used mostly the half-duplex mode; however, during the last two years, many 1200-baud modems have switched to the full-duplex mode.

The final area of protocol is handshaking and error checking. This protocol is usually unnecessary in 300-baud communications because most computers and printers can process 30 characters per second. At higher speeds, however, two problems become more pronounced. Telephone line interference can garble a transmitted character, turning the received character into nonsense. A second problem occurs when the user tries to print and/or store on disk the transmitted information. Most printers will lose a character or two when printing the information as it is received, especially at baud rates higher than 300. When the transmitted information is "captured" on the disk drive, characters may be lost because the computer's attention is focused on saving the information to the disk.

Parity checking detects errors, but it does not correct the error in the transmission. **CRC**, cyclic redundancy check, assures accurate transmission. It is a popular way to make certain that valid information is recorded on the disk drives.

CRC can be used on a block of characters, between 128 and 2,048 characters in length. The largest practical number for transmission is 1,024, and any number under this amount is acceptable. Additional information is sent in the form of special characters at both the beginning and the end of the block.

A **checksum** is placed at the end of the block. The checksum is a one- or two-byte number that is calculated by summing the numeric ASCII values of the characters.

Each character in the block is treated as a number between 0 and 255, corresponding to its ASCII value. The values of these characters are added and transmitted to the receiving computer, where they are added again. After the block is received and all characters have been totaled, the receiving computer checks the total against the total transmitted by the other computer. If the two totals match, the receiving computer signals with a special character that the transmission is correct, and another block of information can be

sent. If the totals do not match, the sending computer is signaled to transmit the block of information again.

The CRC method, used by programs like BSTAM, assures accurate reception of data. The receiving computer can tell if the transmission is successful by comparing its computed checksum with the checksum transmitted by the other computer.

CRC also keeps data from being sent while the listening computer is busy. The sending computer does not transmit until it has received the signal from the receiving computer.

Handshaking is less complex. In **XON-XOFF,** the simplest method, the sending computer begins transmission. When the listening computer cannot receive more characters, it sends a special character to the sender to halt transmission. The transmitting computer waits until the receiver sends another special character before resuming transmission. This method is often used in data as well as computer-to-printer communications.

ETX-ACK is another software handshaking method. The transmitting computer sends a special character and waits for an acknowledgement. When the listener is ready, it returns the special character. The sending computer then transmits a block of information, usually 128 characters. This process is repeated until all characters have been sent.

Both methods are useful for capturing or printing data on the Osborne 1, but neither handles error correction. Although XON-XOFF and ETX-ACK keep the sender from overrunning the receiver's capability, the received information will have errors if a transmission is garbled because of telephone line interference.

Other Telecommunications Considerations

Fortunately, all data bases and telecommunication services speak at 300 baud, or 30 characters per second, a speed faster than a Teletype machine (11 characters per second) and most typists. Common telephone lines may be used at the 1200 baud-rate with most data base services.

The most popular modems for microcomputer communications, 300-baud modems, cost between $300 and $400. Recently, the

prices of 1200-baud modems have decreased to the $700 to $900 range. Most nonprofessional users, however, find that 1200-baud modems are still too expensive, even though their data transmission speed is four times that of 300-baud modems.

All networks and time-sharing systems charge by "connect time," the number of minutes a terminal or computer is connected by telephone line to the host computer. To minimize connect time, the Osborne 1 may be used as an intelligent terminal. Information can be downloaded onto the Osborne diskette for later examination, and precomposed text and program files can be uploaded to the mainframe computer. Because a computer can transmit information faster than most people can type, this method maximizes the Osborne 1's capabilities and reduces time-sharing charges.

The XON-XOFF protocol is used for handshaking with most time-sharing systems. Little error checking is done on garbled transmission. Usually, typing a Control-S will stop transmission, and Control-Q will restart it. CP/M's freeze and resume characters are similar in function.

For communication, both computers must use the same speed and protocol requirements, such as parity checking, and number of start, stop, and data bits. Prewritten communications packages must be flexible enough to handle different protocols.

The most common protocol for communications between microcomputers by telephone is:

Speed:	*300 baud*
Character Set:	*ASCII*
Data bits:	*8*
Protocols:	*Full duplex, XON-XOFF*
Parity Check:	*None*

The Osborne 1 computer can support two sets of speeds: 300/1200 and 600/2400. As supplied, the Osborne 1 handles 300-/1200-baud rates. Higher rates can be used if a jumper is changed on the Osborne 1 system board. This change, which requires disassembling the computer, should be performed by only a qualified person. Because most modems fall into the 300/1200 category, this mod-

ification is unnecessary unless a direct connection between two computers at the 2400-baud rate is desired.

Osborne 1 owners who have access to another CP/M-based computer may want a direct connection for uploading and downloading information. The hardware required for this connection is a cable joining the two computers' RS-232 serial ports. In most cases, the wire between pins 2 (transmit data) and 3 (receive data) and the wire for pins 4 (request to send) and 5 (clear to send) must be reversed at one end of the cable. Because both computers will attempt to use the same line for transmitting data, and the other same line for receiving data, reversing the lines at one end of the connecting cable will provide correct communication.

Software must be considered if the Osborne 1 is to be connected directly to another computer. Each computer must use the appropriate program to transfer programs and data. The programs may be simple, such as CP/M's PIP, which performs "brute force" transfers between systems using the names PUN: (for paper tape punch) and RDR: (for paper tape reader). Although paper tape is not used on the Osborne 1, the serial port is considered the PUN: (the device for sending information to another system) and the RDR: (the information receiver). PIP adds 40 null characters (ASCII 00) to the beginning of the file, does not do handshaking, and cannot transform program or WordStar files unless modified. PIP is "usable" at best. It would typically be used only when no other program is available.

Chapter 8
Acquisition, Service, and Warranty

Once the decision has been made to purchase the Osborne 1 computer, the next concerns are the acquisition, installation, and eventual service of the machine. Because OCC has developed an aggressive dealer policy in getting the product to market, locating a nearby dealer should not be difficult.

Acquisition

At first, OCC looked to the small, independent computer store as the primary target for distribution of the Osborne 1. This approach is standard for a new computer manufacturer. However, OCC grew so steadily that it began negotiating with large nationwide outlets after being in the market for only a few months. OCC established itself as a firm and definite competitor and successfully negotiated dealer agreements on a national level with ComputerLand, Xerox Product Stores, and Sears Business Systems Centers. According to an OCC spokesman, the company's revised strategy was to market the Osborne 1 through high-quality, service-oriented organizations that had a proven track record in both sales and service.

OCC recently added to its list of certified dealers several office equipment dealers, copy equipment dealers, and other high-level business equipment suppliers. These outlets were chosen because of their excellent history of on-site service and their higher level of service as compared to traditional computer stores.

Most computer dealers have a depot-oriented service department; if the consumer has a problem, the system must be brought to the service department and left with a technician for repair. Office supply stores, on the other hand, are accustomed to performing needed service at the customer's location, creating more of a business-to-business relationship than a dealer-to-buyer association.

The Osborne 1 cannot be purchased directly from OCC, but is available only through a dealer network: the Osborne Major Accounts Group, or OMAG, which was organized to manage distribution on a national level. All negotiations with this group are handled on a corporate level with OCC, and OMAG will control only the distribution of the purchased equipment. To qualify for membership in OMAG, which consists of nearly 250 dealers, an established dealer must have an excellent record of outside sales and service, and a good reputation in keeping national accounts.

Although Osborne has no control over the prices that dealers charge for its equipment, the company has a firm policy against discounts and encourages dealers to do the same. If a dealer discounts the product, Osborne tries to determine why it must be discounted to sell well, because the unit already has one of the highest value-for-price ratios in the industry.

An interesting note from Adam Osborne, on the first page of the *OCC Dealer Handbook*, explains the company's selling policy: "We recognize that manufacturing and retailing are two distinctly separate businesses." This philosophy gives control of the retailing and promotion of the product to the retailer, rather than the manufacturer, who is usually less qualified in this area.

OCC's Dealer Policy says that "Dealers will be given every courtesy and consideration. In turn, dealers are expected to provide a high level of support to their customers of OCC products."

The Dealer Policy provides that all sales will be made through dealers, and that Osborne will have no intermediate distributors. It states that dealers must have service personnel capable of maintaining OCC hardware in accordance with established OCC procedures.

Dealer support programs include incentives for dealer personnel to own their own Osborne 1 computers, and software demonstration

diskettes to explain OCC computers to potential customers. OCC encourages dealers to attend local and regional trade shows, and provides promotional material for use at the shows.

In return, dealers are expected to have at least one demonstration computer at all times, and are encouraged to keep a reasonable inventory of OCC Approved Software diskettes.

The Dealer Policy says that "OCC looks upon our relationship with our dealers as a joint venture." To this end, at least one dealer from each geographic region represents that region as a member of the OCC Dealer Advisory Board, which meets regularly throughout the year.

Dealers are prohibited from selling OCC products wholesale or otherwise for the purpose of resale.

These policies for dealers suggest that prospective buyers and current owners of an Osborne 1 computer can expect quality support and capable service from Osborne dealers.

Installation

The actual installation of the Osborne 1 is probably the simplest of any microcomputer sold today. It is so simple, in fact, that only four or five short paragraphs in the 500-page owner's manual deal with installation.

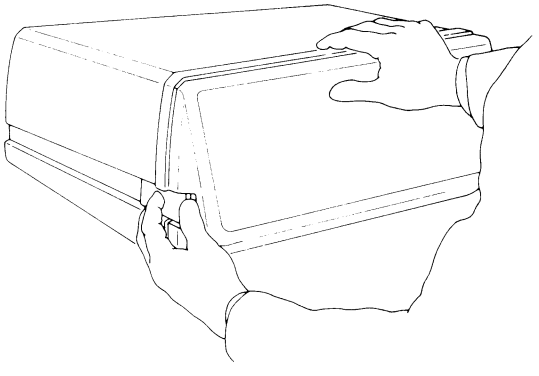
There is little doubt that a majority of first-time computer users feel a bit intimidated when faced with taking their computer home, opening the box, and setting up the computer to the point of being functional. The precedent of a computer that is as portable as an electric razor will undoubtedly impress even the most inhibited user.

The following text and illustrations are reprinted from the Osborne 1 *User's Reference Guide*. (courtesy of OCC)

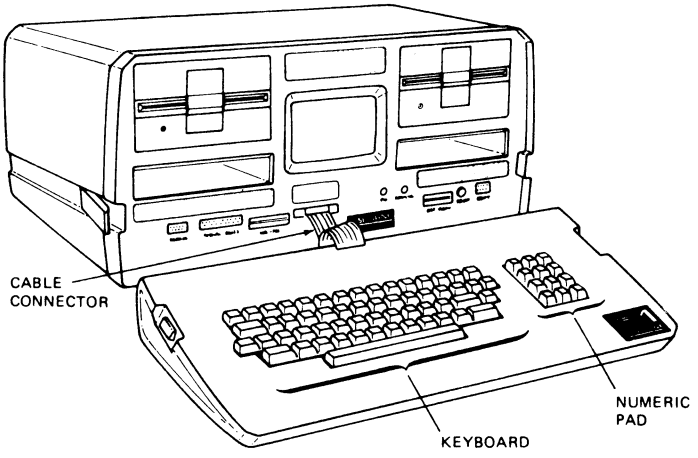
Setting up the Osborne 1 Computer

The Osborne 1 is a sophisticated business machine. To get started, you simply place it on a flat surface, with the two strips of padding facing down. The side with the latches should face you; the handle and power cord should be at the rear facing away from you.

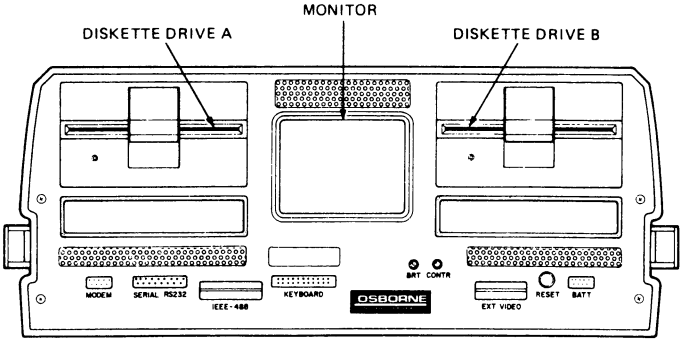
The keyboard is on the inside of the cover, which you remove by unfastening the latches. A cable connects the keyboard to the main body of the Osborne 1. Be careful that you don't violently jerk the keyboard away from the computer; doing so may damage the cable.



The keyboard has a standard typewriter layout, with a ten-key numeric pad on the right side:

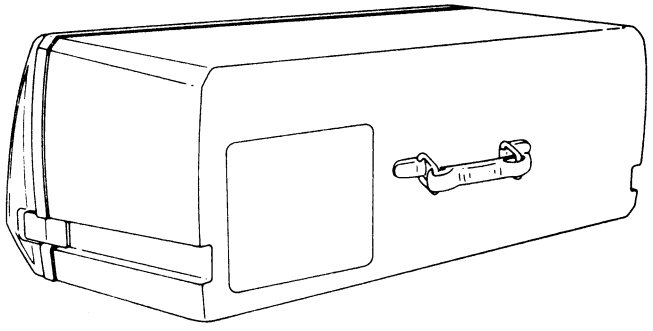


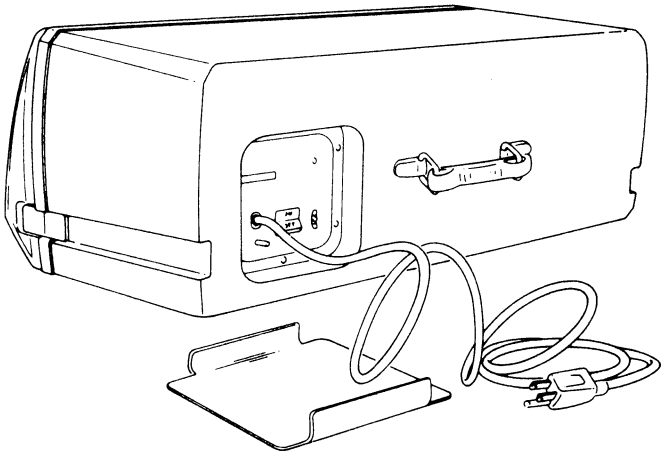
When you look at the Osborne 1, the most prominent features facing you are the display (monitor) and the disk drives:



Orient the display so that it is comfortable. Some people like to set the bottom front of the main computer unit on the back edge of the keyboard. If you try this, you'll find that the monitor tilts up toward you at an almost perfect angle.

Next, plug in the power cord and turn the power on. The power switch is located in the recessed cavity at the back of the machine:





Note that there is a small, round, red circuit breaker next to the power cord. The power switch is broad and flat. Use the circuit breaker only if you experience a circuit overload. If the computer does not function at all try pressing the circuit-breaker button. If a circuit overload is the problem, this button will click into place and restore power to the circuits.

Warranty and Maintenance Service

Osborne Computer Corporation offers a Ninety-Day Limited Warranty and a One-Year Extended Limited Warranty to buyers of the Osborne 1. A quick look at the *Field Service Manual* provided to dealers indicates how serious OCC is about the type and quality of service that is provided to the end user.

Warranty work includes module exchanges (logic board, disk assembly, keyboard, video monitor, power supply, and case) and some mechanical adjustments (disk and video alignment). The Extended Warranty, $285 per unit, extends the warranty period for another 12 months beyond the original warranty's expiration date.

OCC clearly states on page 1 of the *Field Service Manual* that service must be not only available, but also fast. The company further states that all needed replacement parts will be shipped "within twenty-four hours of your request." According to one ComputerLand technician, who has had extensive dealings with the company, OCC backs this up by using overnight express shipping to anywhere in the U.S.

The designers of the OCC unit used service as one of their guidelines. The unit is so highly modular in nature that all repairs can be made on a subassembly level. This method is more economical than troubleshooting at the component level and does not require a highly educated technical expert. OCC offers a self-taught training program that uses video tapes and literature to cover both technical and administrative aspects of service. In addition, OCC provides dealers with several toll-free telephone lines, staffed by factory technicians, to help any troubled technician.

Although the modular nature of the OCC unit makes repair work easy and fast, the replacement cost of the parts involved with a subassembly-level swap should also be considered. The Main Logic PCB Assembly, or the mother board, is the most expensive replacement part at $587. The Disk Drive Unit can be replaced for $331.60; the 5" Video Monitor, for $195.

Pricing List

HARDWARE:

OCC-1 System Unit, 64K, 220V Norweg KB/Sftwre	*$1800.00*
OCC-1 System Unit, 64K, 220V Swedish KB/Sftwre	*1800.00*
OCC-1 System Unit, 64K, 220V	*1800.00*
OCC-1 System Unit, 64K, 2 Drives, 5" CRT	*1795.00*
Battery Power Pack	*345.00*
Comm-Pack 300 Baud Modem	*265.00*

SOFTWARE:

Grammatik	*149.00*
MATH	*49.95*
muMath	*250.00*
BASCOM	*395.00*
BSTAM	*200.00*
DataStar	*350.00*
dBase II	*595.00*
Disk Doctor	*100.00*
Documate	*125.00*
Enumerate	*39.95*
Filefax	*175.00*
Footnote	*75.00*
FORTH	*180.00*
Mailman	*125.00*
Micro Link	*89.00*
Milestone	*295.00*
Money Maestro	*200.00*
Personal Datebook	*150.00*
Personal PEARL	*295.00*
Spellguard	*95.00*
SuperSort	*250.00*

MISCELLANEOUS:

Osborne Extended Limited Warranty	*285.00*
Technical Manual	*49.95*
User's Manual	*14.95*

The OCC One-Year Limited Warranty and the One-Year Extended Warranty Certificate are reproduced here to illustrate further OCC's policies. The documents are followed by the End User Agreements, which explain software restrictions.

END USER AGREEMENT JUNE 1981

WHEREAS, Osborne Computer Corporation of 26500 Corporate Avenue, Hayward, California, hereinafter referred to as **OCC**, is licensed to and as such distributes various proprietary computer programs of various computer software companies including, but not limited to, those of **MicroPro International Corporation ("MicroPro"), Microsoft, SORCIM and Compiler Systems, Inc. ("CSI"),** hereinafter collectively referred to as **"OCC's** computer programs" and sells use licenses for such proprietary computer programs together with or apart from accompanying copyrighted media material and documentation, and;

WHEREAS, a party to this agreement wishes to register and hereinafter be referred to as an **OCC** computer product End User, and;

WHEREAS, End User desires to obtain the benefits thereof and, in return for which, is willing to abide by the obligations and fee agreements applicable to **OCC's** use licenses in said proprietary computer programs;

NOW THEN, for good and valuable consideration, including, but not limited to, license grant in accordance with this Agreement by **OCC** to End User and End User's covenant regarding the properitary rights of **MicroPro,** and **OCC's** other computer program suppliers **OCC** agrees to sell End User materials representing said proprietary computer programs subject to the following terms and conditions;

WITNESSETH

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ARTICLE V. MULTIPLE COPY USE. OCC use licenses are applicable to a single microcomputer installation. In the event End User intends to use an **OCC** product or any computer program distributed by **OCC** or any part thereof on more than one microcomputer, the license fee for each such multiple use must be purchased. In the event of simultaneous use, a license must be obtained for each instance of possible simultaneous execution by a separate microprocessor.

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ARTICLE VIII. LIMITED WARRANTY POLICY. OCC warrants that all materials furnished by **OCC** constitutes an accurate manufacture of such products and will replace any such furnished material to be thus defective, provided such defect is found within ninety days of purchase by End User. However, **OCC** makes NO express or implied warranty of any kind with regard to performance or accuracy of data of any kind nor for any consequential damages resulting therefrom whether through loss or inaccuracy of data of any kind for any consequential damages resulting therefrom whether through **OCC** negligence or not. **OCC** will not honor any warranty where a computer program sold or distributed by **OCC** has been subjected to physical abuse or used in defective or non-compatible equipment. **OCC** will not honor any warranty for which there is no signed End User Agreement Acknowledgment on file at **OCC's** offices. The products provided by **OCC** are intended for commercial use only.

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ARTICLE XII. INJUNCTIVE RELIEF. It is understood and agreed that, notwithstanding any other provisions of this Agreement, **OCC** has the unequivocal right to obtain timely injunction relief to protect the proprietary rights of **OCC** and of its computer program suppliers.

ARTICLE XIII. GOVERNING LAW. When signed in the United States, this Agreement shall be interpreted in accordance with the laws of the State of California. When signed in any

other country, this Agreement will be interpreted in accordance with International Law. In the event any part of this Agreement is invalidated by court or legislative action of competent jurisdiction, the remainder of this Agreement shall remain in binding effect.

ARTICLE XIV. LEGAL FEES. In the event of legal action brought by either party, the prevailing party shall be entitled to reimbursement of legal fees as set by court action.

ARTICLE XV. ENTIRE AGREEMENT. This Agreement constitutes the entire agreement between the parties and supersedes any prior agreements. This Agreement may only be changed by mutual written consent.

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OSBORNE COMPUTER CORPORATION, 26500 Corporate Avenue, Hayward, California 94545, 415-887-8080

OSBORNE COMPUTER CORPORATION

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GLOSSARY OF COMPUTER TERMS

A/D - Abbreviation for analog to digital conversions

Access time - Time required from the instant information is called for to the point delivery is completed on the mass storage system (same as read time).

Acoustic coupler - A device that converts the binary computer signals into audible tones for communications over telephone lines.

Adapter - A device that converts the electrical connections between two similar devices. An adapter typically changes the order of the signal connections between two devices, such as switching or reconnecting two or more wires. This is opposed to an INTERFACE, which alters or converts the actual electrical signals themselves.

Address - 1. n. Name given to a specific memory location, either within the computer or on the storage media, where information is stored.
2. v. The act of finding such a location.

ADP - Acronym for Automated Data Processing.

ALU - Acronym for Arithmetic Logic Unit.

Analog - Representing a numerical value by means of a physical variance or amount (i.e., the amount of voltage). The opposite of digital.

Analog to digital conversion - The process of converting voltage levels (analog signals) to digital (computer) information.

Analog transmission - In telecommunications, a technique of using varying (rising and falling) magnitudes or frequencies. Opposite of "digital transmission" in which discrete, encoded bits of data are sent from point to point.

AND - A Boolean algebraic operator that gives a value of TRUE (or 1) when both variables tested by the AND are also TRUE.

ANSI - The American National Standards Institute, an non-profit, non-governmental organization that acts as a clearinghouse and coordinating body for voluntary standards concerning computers and information processing. ANSI establishes standards for character sets (ASCII), high level languages (BASIC, FORTRAN, COBOL, etc.), data communications (X-12, X-25 protocols), and other data processing standards.

Arithmetic Logic Unit - The part of the microprocessor that actually performs the arithmetic and comparison functions of the computer system. The ALU can usually add, subtract, and compare characters or numbers. From these functions, the system can perform higher level mathematics and comparisons.

ASCII - Acronym for American Standard Code for Information In-

terchange (pronounced "ASS-key"). Most word processors and computers "talk" in this format, where each combination of the different eight bits in a byte represents a unique character.

ASR - Acronym for Automatic Send-and-Receive. In terminals, a combination typewriter, transmitter, and receiver with telephone transmission capabilities to talk with a computer.

Assembly language - A machine-oriented language for programming. In these low-level languages, the programmer works just a level above the basic 1's and 0's the machine understands. While these programs are difficult to develop, they run very quickly. For example, most word-processing programs are written in "assembler" language.

Assembler - A computer program that takes the humanly readable assembly language program (SOURCE CODE) and converts it into a machine executable program (OBJECT CODE). Assemblers are CPU dependent and work with only one type or family of CPUs. Hence, an assembler for a Z80 microprocessor will not produce the proper instructions for an 8085 or 6800 microprocessor.

Asynchronous - In communications between devices, the lack of a set timing between the transmission of characters. Extra signals are transmitted to inform the receiving device that a complete character has been transmitted. Most serial communications between microcomputers, printers, and modems are asynchronous. See BISYNCHRONOUS.

Auxiliary memory - Memory storage that is external to the computer. Also known as MECHANICAL MEMORY and MASS STORAGE. Disks and magnetic tape are forms of auxiliary memory. These memories are non-volatile; the recorded data is preserved if the power is lost.

Back up - To duplicate a file or library onto a separate piece of media in case of inadvertent loss of the original. Backing-up on a regular basis minimizes recovery time due to a system or media fault. Humorously labelled "data processing's cheapest insurance."

Background - In time-sharing or multitasking, the lowest priority work the computer will perform when no other work is to be done. Some programs have the ability to "background print," i.e., will output to the printer while waiting for operator's input during editing or other functions.

Band printer - A high speed printer (50-600+ lines per minute) whose characters are on a closed-loop band or chain, which is struck by a small hammer as the character comes into the correct position over the paper. Because of their high cost ($5,000 up), they are not commonly used in word-processing applications. Also known as CHAIN PRINTER.

Base - The quantity of characters in each digit of a numbering system. Common numbering systems are:

1. Binary (base 2: 0, 1)
2. Octal (base 8: 0, 1, 2, 3, 4, 5, 6, 7)
3. Decimal (base 10: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
4. Hexadecimal (base 16: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F)

BASIC - Acronym for Beginner's Algebraic Symbolic Instruction Code, a common, easy-to-learn computer programming language originally developed at Dartmouth University.

Batch - A collection of similar work that can be processed in one operation.

Baud - A measurement of communications speed between devices. Generally means bits transmitted per second. When the baud rate is divided by 10, baud usually represents the number of characters transmitted per second.

Baudot code - A teletypewriter code in which the five bits represent one character. (See also ASCII.)

BCD - Acronym for Binary-Coded Decimal, a method of internally representing numbers within the computer.

Benchmark - A standard used to judge something; a point of reference. A benchmark program is a standard program used to judge throughput on different computer systems.

Binary - The native language of all computers. Numbers, letters, and instructions are represented in 1's and 0's (or ON's and OFF's) inside the computer.

BIOS - Acronym for Basic Input/Output System, a software program or subprogram of the operating system that handles the communications between the computer and its peripherals.

Bit - Contraction for BInary digiT. A single 1's or 0's switch. The smallest unit of information in a digital computer.

Black box - A slang term for the central processing unit or computer. Also a device that converts data from one computer format to another.

Boolean - An algebra developed by George Boole. Boolean algebra concerns logical operations (for example: AND, OR, NOT, NOR, XOR) as opposed to mathematical operations (+, -, , /,).

Boot or **Bootstrap** - The loading and executing of a few instructions that in turn load the remainder of the program. Used in terms of the disk drive when the operating system is "booted" or loaded in.

Buffer - An auxiliary device or memory section that temporarily holds data until it can be transmitted or processed by another device. This compensates for the different rates of data flow between such devices as the computer and printers or terminals.

Buffer storage - A device in which information that is ready for transfer is assembled and temporarily stored.

Bug - A hardware or software error. Bug was first coined from early computer days when a singed butterfly was found to have caused a malfunction in the MARK I computer.

Byte - The basic measurement unit of computer memory. A byte consists of eight on or off switches or bits. Each character or number usually occupies one byte.

Cancel - To stop or abort a process or selection in progress.

Carriage return - The key that causes a return to the left margin. Also used to signal the end of an input. Also known as "ENTER" on some keyboards. (13 dec or 0C hex).

Catalog - In some systems the list of files on the storage media. It also contains the information needed by the computer to keep track of the physical locations on the storage media of the various files. Also known as DIRECTORY.

Central Processing Unit - (CPU) - The unit of the computer that contains the necessary circuits to interpret and execute instructions. This unit commands the processing done by the computer.

Chain - The invoking (running) of one program from another program with the variables remaining intact.

Character - A single digit, letter, punctuation mark, or other such symbol, which the computer can read or write. In most microcomputers or word processors, one character is stored or expressed in one byte.

Character printer - A hard copy device that prints one letter at a time. Typewriters are character printers. These are slower than line printers, which print a line of characters at one time.

Checksum - The checking of the validity of data, either when placed on the mass storage or transmitted to another system. The checksum is accomplished by adding the value of the characters used, and this total (or sum) is marked on the storage device or transmitted to the receiving device. The characters involved are re-totaled by the receiving device, and the checksum is compared.

Chip - An integrated circuit. This fingernail-sized device comes from a larger silicon-based wafer, which is cut or "chipped," thus producing this name.

Clock - 1. A pulse-producing device for the synchronizing of the computer operations (System or Master clock).
2. A device to record past or used time (Real-time clocks).

Clock rate - The number of pulses per second generated by the system or master clock. Generally measured in MHz (Millions of Hertz or cycles per second) or GHz (billion Hertz), each pulse causes one machine or CPU cycle.

COBOL - Acronym for COmmon Business Oriented Language, a widely used high-level computer

programming language for business.

Code - 1. The symbols that represent instructions or data to the computer.
2. To program the commands for a computer.
3. A computer program.

Command - The signal or set of instructions that start or stop an operation.

Command processor - The program or subprogram of the operating system, which interprets the directions typed on the system console.

Compiler - A program that takes English-like commands and converts them into directly executable instructions. Compiled programs execute more swiftly than interpreted programs. (See INTERPRETER)

Computer - A device capable of accepting data, applying prescribed processes to this data, and displaying the results or information produced. Generally made of input and output devices; storage units; and arithmetic, logic, and control units.

Console - The unit containing the special controls that power, start, and stop the computer as well as display the internal status of the machine. In some computers, the console may examine and alter the contents and operation of the computer. Also the principal or main input/output terminal or CRT.

Conversion - The processes of changing data from one processing method to another; i.e., from one computer to another, from accounts payable program's storage format to word processing, from a magnetic tape to a hard disk.

Co-processor - An additional computer processing unit that handles specific tasks in conjunction with the main or central processing unit.

Copy - To reproduce data from one area to another. When a program is "read" into a computer, a copy is made inside the internal memory with the original program remaining unaltered. When a disk is copied, a duplicate of each file is created on the destination diskette. The source (original) diskette remains untouched.

Core - Formally, a piece of magnetic material that was manipulated to represent the binary information inside the computer. Today, the internal semiconductor memory of the computer.

CP/M - Control Program/ for Microprocessors, a popular disk operating system for microcomputers developed by Digital Research, Inc.

CPS - Abbreviation for Character Per Seconds, a standard unit of measurement for printer output.

CPU - Abbreviation for Central Processing Unit.

Crosstalk - Interference on computer circuits or lines, principally when the magnetic fields created

by electricity moving through a circuit or line undesirably influences another circuit or line.

CRT - Abbreviation for Cathode Ray Tube.

Cursor - The display screen's indicator where the next character will be typed.

Cycle - The basic unit of measurement of the central processing unit's activity. An average discrete instruction to the CPU will take five clock pulses or cycles of time on a microcomputer.

Cylinder - A term used primarily with hard disks; the number of tracks on a disk drive that can be accessed without repositioning the recording heads. Each side of a diskette or platter that holds information is considered a cylinder.

D/A - Abbreviation for Digital to Analog Conversion

Daisy wheel printer - A hard copy device that creates characters by use of a print wheel. Otherwise known as CORRESPONDENCE PRINTERS, the daisy wheel printer is used principally in business correspondence. See also PRINT WHEEL.

Data - Groups of facts that are processed into information. The alphabetic or numeric representations that are worked on by the computer.

DD - Abbreviation for Double Density diskette types.

DDT - A sophisticated, on-line program debugger.

Debug - To correct or remove an error in the computer's hardware or software. (See BUG.)

Density - The amount of space vs. the amount of information stored. Density refers to the compactness of the information stored on the available storage media, or the number of TRACKS per inch. SINGLE DENSITY 5-1/4 inch (mini-floppy) diskettes hold approximately 80 - 90 K(ilobytes); 8-inch diskettes hold 243 K. DOUBLE DENSITY floppies hold twice as much as SINGLE DENSITY diskettes. QUAD DENSITY diskettes hold four times as much as SINGLE DENSITY diskettes. EXTENDED DENSITY diskettes (infrequently used) hold approximately 2-1/2 times as much as SINGLE DENSITY. See also SIDES, TRACKS, SECTORS, and TPI.

Device - A mechanical, electrical, or electro-mechanical contrivance or appliance. Commonly used in conjunction with peripherals, such as printers, CRTs, and disk drives.

Dial up lines - Computer communications through normal (dial or touch tone) telephone lines.

Digital - The method of expressing information by the use of separate, integral numbers (usually the numbers 0 or 1).

Digital to analog conversion - The process of converting digital (computer) information into electrical signals of appropriately varying voltages (analog).

Directory - The list of files; their attributes, where they are kept on the storage media. Sometimes known as CATALOG.

Disk - A circular plate with magnetic material on both sides. This plate rotates for the storage and retrieval of data by one or more "heads," which transfer the information to and from the computer. The computer-readable information may be placed on a "floppy" or rigid (hard) disk and may have information on one or both sides. Also known as DISKETTE or DISC.

Disk drive - The piece of hardware that holds the motor, read/write heads, and electronics for use with a disk. The disk is inserted into the drive, which in turn is responsible for the communications between the disk surface and the computer.

Disk crash - When the disk unit's recording head makes destructive contact with the recording media. Also, a disk drive malfunction.

Display - Another term for CRT.

Documentation - The humanly readable description of a computer program. Program documentation describes the interworkings of the purpose, logic, relationships, and coding of the program itself. User documentation gives instructions on the operation of the program and the necessary commands and input to make it function.

DOS - Acronym for Disk Operating System. The program responsible for the housekeeping and communications between the disk storage device and the computer. The DOS is also usually responsible for communications between the computer and other peripheral units.

Dot-matrix printer - A hard copy device that creates characters using a series of wires which produce dots, usually 5 wide by 7 high. Recently, higher-density dot-matrix printers have emerged that use up to 126 dots to form a character which has a sharper, more fully formed appearance. Through generally a higher speed printer, the characters from the lower density printer are usually not satisfactory for business correspondence.

Downtime - The operation time lost because of a computer malfunction.

DP - Abbreviation for Data Processing.

Driver - An operating system's subprogram or module that controls the input and output from a specific device, such as a disk drive or printer.

DS - Abbreviation for Double Sided floppy diskettes, where both sides of the flexible media are used to record data.

Dump - 1. To print or display the contents of the computer's memory or a disk file.
2. To transfer a copy of memory or a disk file to another device.
3. To lose inadvertently power to the computer or accidentally abort a program.

Duplex - A method of operating a communications channel between

two devices. "Full-Duplex" allows both units to send and receive simultaneously. "Half-Duplex" allows only one unit to send information at one time.

EBCDIC - Acronym for Extended Binary Coded Decimal Interchange Code, a standard code used in data processing and found mainly on IBM or IBM-compatible computer equipment.

ECC - Error Checking and Correcting, a type of self-diagnostic and self-correcting RAM board. As all RAM occasionally suffers from SOFT DROP, ECC memory prevents some improper computer operations due to SOFT DROP memory problems.

ED - 1. The provided editor program for CP/M.
2. An abbreviation for Extended Density.

Editor - A computer program that performs editing operations.

EDP - Acronym for Electronic Data Processing.

Electronic storage - The computer's main or internal memory divided into read/write memory (RAM) and read only memory (ROM). RAM electronic storage is power vulnerable and is lost if there is any interruption of power to the computer. See also RAM and ROM.

Electrostatic printer - A printer that uses a special metalized paper and sends an electric charge through the paper, thus creating the characters. Although fairly fast (100 cps), these printers are principally used for draft or in-house work.

End of file - A special indicator to mark that the end of a disk file has been reached. Attempting to read information past this point generally produces a computer error.

Error - Traditionally, the amount of deviation between a computed amount and the correct value. Also, a flaw in programming or in the operations of a program.

Extension - Usually, a three-character suffix used with a file name to denote the file's usage.

External memory - Another term for auxiliary storage.

FDC - Abbreviation for Floppy Disk Controller; the integrated circuit that controls and communicates with the floppy disk drive.

Fetch - Obtain data or instructions from the computer's storage, either the electronic storage (RAM or ROM) or mass storage (tape or disk).

FIFO - Abbreviation for First In, First Out.

File - A collection of similar data. A group of related records treated as a unit. Most generally used in conjunction with the mass storage unit.

Firmware - A computer program that is permanently fixed inside a chip. Firmware is nonvolatile and remains intact if power is lost. Monitors and other commonly used programs are placed in firmware (the cross between hardware and software).

Flag - An indicator that a specific action has, or has not, occurred. Also, to call attention to an indicator.

Flippy - A type of floppy diskette that can be used on single-sided disk drives. Two sets of write-protect notches and index holes allow the diskette to be turned over and information recorded on its front side.

Floating point numbers - A non integer number; a real or imaginary number.

Floppy disk - Also known as DISKETTE, a disk made of flexible, magnetic medium and housed in a cardboard envelope. The disk spins at approximately 300 r.p.m. inside its jacket (envelope). The material is read through an access hole that makes contact with the surface. A floppy disk is normally the 8-inch diameter type, whereas a mini-floppy is 5 1/4 inches. However, the two names are frequently interchanged.
A floppy disk can hold between 256 KB (kilobytes) and 2.4 MB (megabytes). Mini-floppies hold between 80 and 635 KB.

Foreground - The computer program(s) in a multitasking or time-sharing machine which have the highest priority over other functions.

FORTRAN - Acronym for FORmula TRANslator, a popular engineering and scientific computer language.

Function - A special purpose or specific action.

Gigabyte - One billion bytes (2 to the 36th power or 1,073,741,824 bytes).

GIGO - Abbreviation for: 1. Garbage In, Garbage Out. 2. Garbage In, Gospel Out.

Gone west - A slang term for when the computer has entered an endless loop and control of the computer is lost.

Handshaking - The electronic process where communicating units query one another to insure each is ready for transmission and information will not be lost. Handshaking insures the receiving device is ready to capture information and the transmitting device will not send until such acknowledgement is given.

Hard copy - The humanly readable paper copy or printout of information.

Hard disk - A disk made of a rigid, ceramic-like material with a magnetic coating. These disks spin at approximately 3600 r.p.m. and are contained in a sheltered environment to prevent damage from dust, smoke, etc. Hard disk capacity is measured in the millions of bytes (megabytes). Their "heads" "fly" over the disk surface at a distance less than a human hair. They are often vertically stacked in groups called cylinders and render hundreds of megabytes of storage.
Hard disks come in two types. Removable disks or disk packs can be mounted and removed from the disk drive. Care must be exercised with removable disks as a finger-

print, hair, or dirt may cause the read/write head to skip and then fall into the disk surface. This is called disk crash and generally causes the loss of all data on the disk as well as damage to the heads. Winchester disks have their read/write heads sealed into the same shell with the platters, thus greatly reducing the chance of disk crash and improving reliability.

Hard drop - The malfunction of a RAM memory location. A HARD DROP causes the individual RAM (bit) location to freeze into either the on or off mode permanently, and replacement of the defective RAM chip is necessary.

Hardware - The physical equipment of the computer system. Included are terminals, memory boards, printers, and disk drives.

Head - The small electromagnetic device inside a tape or disk drive that reads, records, and erases data on the media.

Hex - Abbreviation for hexadecimal.

Hexadecimal - Base 16. The numbers 0-9 and the letters A-F are used to express the numbers from 0 to 15. The letters A - F are used to express 10 - 15 where A=10, B=11, C=12, D=13, E=14, and F=15.

Home - On a video display, the position in the upper left hand corner where the first printable character is placed.

Housekeeping - Overhead operations or administrative functions that are necessary for efficient operation, but do not directly contribute to the solution of the task.

Hz - Abbreviation for Hertz (cycles per second). Used in terms of clock rate.

I/O - Abbreviation for Input/Output.

Initialize - To start up or set up the basic conditions. When disks are initialized, they are formatted to accept data that will be stored later. When a program is initialized, the various routines and data it will later need are established. Initialization generally destroys what was previously recorded in the affected memory locations.

Input - The data or information that is received and stored inside the computer's internal memory. Input may come from disk drives, keyboards, modems, etc.

Instruction - A program step that tells the computer what to do for a single operation.

Integrated system - 1. Programs that allow introduction of new or allied data into an existing set without having to re-enter the previous data. Thus a customer name need not be re-entered for use with both accounts receivable and inventory control.
2. Hardware that works together without further need of additional circuits to allow communications between devices.

Interface - The boundary or device between two parts of the computer, or between computers, which allows communication to take

place. For example, printers must be "interfaced" to the computer in order for the computer to "talk" to the printer to produce hard copy.

Interpreter - A program that acts as a go-between for another program. Most BASICs are interpreted; each program command is translated into the proper instructions, which the computer then performs. Interpreted languages allow easier development of programs, but sacrifice operating speed.

Interrupt - 1. A break in the normal flow of a program or routine that can be continued from that point later in time.
2. A control (hardware) signal that diverts the CPU from the main program to another task.

IPL - Abbreviation for Initial Program Load, the loading of the operating system. On microcomputer systems, the terms IPL and BOOTING or Bootstrap are identical.

K or **KB** - Abbreviation for KiloByte (1,024 bytes).

Keyboard - The principle device for communication to the computer (input). The keyboard is a typewriter-like device that has several more keys to enable the more complex functions of the computer; i.e., the CONTROL or ESCAPE keys. Most are QWERTY (CAWERE-tee) type like the familiar typewriter but some have additional keys for the use of some special languages like APL (A Programming Language). Others will feature a numeric key pad for rapid entry of numbers.

Kilobyte - 1,024 bytes or characters, actually 2 to the 10th power. Roughly corresponds to one-half of a typewritten page. (Note that most computer terms speak of 2 raised to a power, thus yielding a number greater than what the normal prefix would mean.)

KHz - Abbreviation for KiloHertz (1,000 cycles per second).

Kludge - A humorous term for a black box or the computer. Also a hastily formed interface between devices.

KSR - Abbreviation for Keyboard Send and Receive unit. This is a printer device with a keyboard, receiver, and transmitter for use as a terminal.

Language - The set of instructions that are understood by the computer. High-level languages such as BASIC and COBOL are in more humanly comprehensible form than low-level languages like assembler or machine code. Higher level languages generally take much longer to execute than lower level ones, unless they are compiled into a directly readable machine code. Languages are used mainly by programmers to develop new functions for the computer. (See COMPILER and INTERPRETER).

Letter quality printer - A printer that uses a fully formed character like a typewriter or the text on this page. Also known as CORRESPONDENCE QUALITY printers for their preference in most business communications.

LIFO - Abbreviation for Last In, First Out.

Line printer - A printer that prints one line at a time, rather than a character after a character. Most line printers are bi-directional, able to print in either direction. Line printers may be dot matrix, band, or ink jet.

Loop - A series of instructions that are executed over and over for a set amount of times. A continuous loop is a series of instructions that will repeat indefinitely, thus causing loss of computer control.

LPM - Abbreviation for Lines Per Minute. Used in measuring printer output speed.

Machine code - The native language of the computer or CPU. The 1's and 0's that represent program instructions to the CPU. The fastest executable programs are machine code.

Macro - In assembly language programming, some assemblers (the program that translates the commands into computer executable instructions) allow a key word (a macro) to represent many lines of commands, thus making assembly language programming more efficient.

Main memory - The internal memory of the computer. Also known as RAM or CORE. Programs and data are brought into main memory, where they are processed. Main memory is volatile, and its content is destroyed if the power is lost. Most input and output are processed through the computer's main memory.

Mass storage - A mechanical, nonvolatile memory device. Mass storage units include magnetic tape and disks, punch cards, and paper tape. Currently, experimentation is being conducted to use bubble-memories (high-density semiconductors), video tape and disks for use as mass storage devices. (Corvus Systems, Inc., is currently using video tape as a back-up medium for their hard disk).

MB or **M** - One million bytes (1,048,576).

Media - The material on which data is stored. Included are punch cards and paper tapes; mini-floppy, floppy, and hard disks; and video tape. The more efficient, high speed devices use a metal oxide coating that can store thousands to millions of bits per inch of surface. Magnetic media is sensitive to stray magnetic fields produced by electric motors, X-ray machines, CRTs, televisions, etc., and care must be exercised near such sources.

Megabyte - One million bytes, actually 2 to the 20th power (1,048,576).

Memory - Any unit into which information can be copied, held, and later recalled. Synonymous with STORAGE.

MHz - Million Hertz or cycles per second. A computer that operates at 4 MHz has a clock cycle time of 25 billionths of a second.

Microcomputer - A computer system that is based on a microprocessor. Recently, the microcomputer has approached the power and internal structure of the minicomputer, and a good definition delineating the two is lacking. Generally, a microcomputer costs less then $20,000.

Microprocessor - A computer on a chip; an integrated circuit that contains most of the elements of a computer. Also known as CPU, microprocessors are also found in some printers, disk drives, terminals, and a variety of noncomputer items. When these chips are used for a single purpose within a device, they are known as DEDICATED or DEDICATED MICROPROCESSORS.

Microsecond - A millionth of a second. (1 second = 1,000,000 microseconds.) Abbreviated "uS" or "usec".

Millisecond - A thousandth of a second. (1 second 1,000 milliseconds.) Abbreviated "ms" or "msec."

Mode - A method of operation or a phase of program operation.

Modem - Acronym for MOdulator-DEModulator. A device that translates computer-compatible signals into pulses that can be transmitted and received over noncomputer lines, such as telephones or optical cables. See ACOUSTIC COUPLER.

Modify - To alter or change a program.

Monitor - 1. A special display screen designed to produce a sharper, higher resolution image than conventional picture tubes.
2. A program that supervises the operations of the computer. Also, a program that controls the basic housekeeping and input/output of the computer system.

Multitasking - The ability of the computer to do more than one job or program at one time.

Multiuser - The ability to have more than one person using the resources of the computer at one time.

Nibble - A set of 4 or 5 binary digits (bits). Usually, this term refers to 4 bits.

Object code - A directly machine-executable program.

OCR - Acronym for Optical Character Reader. OCRs can read either special symbols (i.e., the Universal Product Code stamped on most merchandise, or the magnetic ink on checks) or normal text. The OCR transmits its information to a computer and is reaching a state of dependablity to be used in such input tasks as the reading of document text or legal forms.

OEM - Acronym for Original Equipment Manufacturer, firms that purchase components or semi finished equipment to add to their products before distributing. For example, many computer manufacturers are an OEM for dot-matrix or letter quality printers that are bought from the printer manufactur-

er and sold with the computer system.

One or **1** - In binary code, the representation of an "off," "no," or "false." The complement to 0.

Operating system - The collection of programs for operating the computer. Operating systems perform housekeeping tasks, such as input/output between the computer and peripherals and accepting and interpreting information from the keyboard.

ORG - Abbreviation for ORiGin, a pseudocommand in assembly language to specify the starting memory address of a program. Most CP/M systems use an address of $100 ($ hexadecimal notation) for the start or origin of their programs. Some computers use $4200 for their CP/M program's origin as these have Read-Only memories that occupy these lower memory spaces.

Output - 1. Information processed by the computer and displayed to the terminal, printer, or other similar device.
2. Information transferred from the internal storage of the computer to an outside device, such as a disk drive.

Parallel - In communications, the method of sending an entire character or word at a time over a series of computer lines rather than breaking them up into their component elements. Parallel communication between the computer and printers requires less circuitry and is generally faster. However, because of the possibility of electrical interference, parallel lines are shorter in length (generally less than 10 feet). See also SERIAL.

Parity - A method of error checking in which an extra bit is sent to the receiving device to indicate how many binary 1's were transmitted. The receiving unit compares the information received against this bit and can obtain a reasonable judgment to the character's validity. Parity may be EVEN, ODD, or MARK (No parity bit sent). Used in SERIAL communications.

Peripheral - A device used in computer systems that is an attachment to the computer itself. Disk drives, terminals, and printers are peripherals.

Picosecond - One thousandth of a nanosecond. (1 second = 1 trillion picoseconds).

Printer - A device for producing a humanly readable copy of results from the computer. Printers may be thermal, electrostatic, dot matrix, band, or letter quality. They may platen-feed one sheet at a time like a typewriter or use a tractor-feed for continuous paper.

Print wheel - The character impression portion of a correspondence-quality printer. A print wheel is a circular device made of plastic or metal. The characters are arranged on spokes around this central hub. The print wheel rotates, and a hammer strikes the particular spoke that creates the character on the paper. Print wheels come in two varieties: DAISY WHEEL for the Diablo or Qume-types of printers; and THIM-

BLES, which are shaped like an inverted thimble and used on NEC-type of printers.

Program - A set of instructions or steps telling the computer how to handle a problem or task. Also known as SOFTWARE or FIRMWARE.

Queue (pronounced CUE) 1. A line. 2. A line or series of items waiting for attention by the CPU. A printer queue holds the series of items that will be outputed as the printer finishes each task.

R/O - 1. In printers, a Receive Only unit, which does not have a keyboard.
2. In some operating systems, a Read-Only disk or tape file.

RAM - Acronym for Random Access Memory. Also known as the MAIN or INTERNAL memory. Actually, a misnomer, as almost all semiconductor memory can be accessed randomly. It refers to Read/Write memory, which can be altered. Data may be placed into, held, and read from these memories. RAM memories are volatile; their contents are destroyed if the power is lost. All computers have RAM memory.
RAM is subdivided into two classes: DYNAMIC, which is stored capacitively and must be recharged (refreshed) every 2 microseconds or its contents will be lost; STATIC, which is stored in a stable "flip-flop" mode, but requires larger, more energy-consumptive circuitry. In the case of DYNAMIC RAM, the refreshing occurs in a manner that is unnoticed by the remainder of the computer system.

Read - To retrieve information from a memory or storage media. Reading a disk places a copy of the contents into the RAM of the computer. The original data is not altered.

Record - A group of related facts or fields containing information about one individual person or item. A group of records is called a file.

ROM - Acronym for Read-Only Memory. Another form of INTERNAL MEMORY; commonly used programs are placed inside a chip to be read by the computer. The chip itself is called a ROM. ROM memories are non-volatile, and their contents remain if the power is lost. Subclasses of ROM are PROM (Programmable Read-Only Memory) and EAROM (Electrically Alterable Read-Only Memory). See FIRMWARE.

RUN - To execute a program. Also, the execution of a program as in "program run."

Scan - To search memory or a storage file for a particular item.

Sector - The smallest addressable space on a disk's media. A sector is the evenly divided subsections on a TRACK that holds the stored data or programs. See TRACK.

Serial - The handling of data, one item after another. In communications, a serial transmission breaks each character into its component bits and sends these bits one at a time to a receiving device where they are re-assembled. Although more costly than PARALLEL connections, serial cables can span

greater distances than PARALLEL connections. RS-232 is an IEEE standard for serial transmission. See also PARALLEL.

Side(s) - The number of floppy disk sides which are used to record information on. The abbreviations used are SS for single-sided and DS for double-sided recordings.

Soft drop - A phenomenon in RAM memory where a memory location(s) is altered because of background radiation or other electrical interference. The SOFT DROP rate in most RAM memory is once in every several trillion memory accesses. Most SOFT DROPS occur in unused memory locations and go unnoticed by the computer's users. Since a typical 64K RAM computer has over one-half million individual memory locations, SOFT DROP can be critical. See also HARD DROP.

Software - The series of instructions loaded into the computer's internal or RAM memory that tells the computer how to accomplish a problem or task.

Sort - To place information in a specified order, alphabetically, numerically, last-in first-out (lifo), first-in last-out (filo), etc.; a program that sorts.

Source code - The humanly readable computer commands written in a higher level "language" that are changed into the instructions the computer can directly understand. This text file is directly readable by the computers when compiled and turned into OBJECT CODE. The source code may be written in a language that is translated into instructions for the computer by an INTERPRETER instead. (See COMPILER, INTERPRETER, OBJECT CODE, AND LANGUAGE.)

Spooling - A technique for using slow peripherals (principally printers and occasionally modems) whereby the information to be sent to these devices is held in special disk or memory area (queue). As CPU time becomes available, the computer outputs information to these devices. This is done because computers operate at much higher speeds than printers or modems. Spooling allows a computer to operate efficiently on other items without tying up the entire resources of the system on outputing information to a slow device.

SS - Abbreviation for single sided, or using one side of the floppy disk for recording information.

Stack - The area inside the RAM memory where the computer temporarily holds information that is vital to its program's operations.

Storage - The general term for any device that is capable of holding data which will be retrieved later.

String - Data which consists of letters, numbers, punctuation marks, and special characters that the computer will not use in numeric calculation. Any combination of characters may be in a string. Note that whereas numbers may be in a string, characters may not be in numeric data.

Synchronous - In communications, transmission of data occurs based on a regular timing interval.

No additional information is sent to signify the start and stop of a character.

System - The input, processing, and output of information. A computer system is all of the necessary hardware and software required for operation.

Tape - A strip of paper or a piece of celluloid or mylar coated with a metal oxide. Computers may use a paper tape, an audio cassette tape, an open reel tape, or a cartridge-like tape for the storage and retrieval of data. The latter two are high-density, high-speed storage materials more suited for business use.

Telecommunications - The use of telephone lines to transmit data between computers or terminals. This term refers to the use of automatic or automated message and/or data sending and receiving.

Teleprocessing - An IBM registered term describing systems that transmit data from one point to another during the course of processing the information.

Thermal printer - A hard copy output device which uses chemically treated paper that darkens when exposed to heat. The pins on the print head heat and cool, which creates the character's dots on the paper. Thermal printers produce approximately 30 cps and are used principally in quiet environments where print quality is not critical.

Throughput - The time measurement of the system's ability to accept data, process it, and return the results.

TPI - Abbrevivation for Track Per Inch, a measure of disk recording capacity. The higher the TPI, the more information the media can record.

Track - The information path on magnetic media. On disks (mini-floppy, floppy, or hard), the media is broken into a series of concentric circles with each circle being a track. Tracks are subdivided into SECTORS.

Utility - A program used to assist in the operation of the computer; i.e., a sort routine, a printout program, a file conversion program, etc. Generally, these programs perform housekeeping functions and have little relationship to the actual processing of the data.

Virtual - Apparent. A method used to exchange swiftly portions or pages of internal or core memory with the disk storage unit. This exchange (swapping) is handled by special programs or the operating system and allows programs or files to be processed that are larger than the internal memory.
Virtual memory is the ability to use programs that are larger than the internal memory. Virtual memory is principally used on larger systems and allow 64K of RAM memory to become over 512K of virtual memory. Virtual memory is only practical in systems with very rapid disk storage units (hard disks).
Virtual text files are automatically paged in and out of the computers so the user may edit files larger than the internal memory. Sometimes called DISK BUFFERING, virtual text files allow convenient edit-

ing of very long documents (25 - 300+ pages).

Winchester disk - A fixed, rigid disk that uses the IBM-developed Winchester technology. The Winchester disk is in a sealed unit. The read/write heads "fly" over the surface of the disk at a distance less than a human hair and allow more compact storage of data. Winchester disks for microcomputers may store between 5 and 190 megabytes (million bytes). Winchester disks are expensive ($2,500 up), but offer the most cost effective, rapid-access mass storage today.

Word - A unit of data or the set of characters that occupies one storage location. In microcomputers, a character, a word, and a byte are interchangeable. In most minicomputers, a word is equal to two bytes.

WP - Abbreviation for Word Processing.

Zero or **0 -** In computers, a "true," "on," or "yes." Also, the complement to 1 in the binary system. One of the two signals a memory location can hold.

WordStar Reference Card

NO-FILE COMMANDS

Description	Command
Edit document file	D
Rename file	E
File directory on/off	F
Set help level	H
Change logged disk	L
Merge-print (optional)	M
Edit non-document	N
Copy file	O
Print	P
Run program	R
Exit to operating system	X
Delete file	Y

HELP MENUS

Description	Command
Help menu	^J
Block menu	^K
Onscreen formatting menu	^O
Print menu	^P
Quick menu	^Q

CURSOR MOVEMENT

Description	Command
Right character	^D
Left character	^S
Up line	^E
Down line	^X
Right word	^F
Left word	^A
Tab right	^I
Top of screen	^QE
Bottom of screen	^QX
Beginning of file	^QR
End of file	^QC
Right end line	^QD
Left side screen	^QS
Block beginning	^QB
Block end	^QK
Position before previous command	^QP
Start of last find/ replace	^QV
To marker 0-9	^Q0-Q9

SCROLLING

Description	Command
Down line	^W
Up line	^Z
Up screenful	^C
Down screenful	^R
Continuous *up* scroll	^QZ
Continuous *down* scroll	^QW

BASIC EDITING COMMANDS

Description	Command
Delete character right	^G
Delete character left	DEL
Delete word right	^T
Delete line	^Y
Delete to end of line	^QY
Delete to beg. of line	^QDEL
Insert on/off	^V
Insert carriage return (blank line)	^N
Reform paragraph	^B

FORMATTING

Description	Command
Paragraph tab	^OG
Variable tabbing on/off	^OV
Center line	^OC
Left margin set	^OL
Right margin set	^OR
Margin release	^OX
Set margins and tabs from file line	^OF
Tab set	^OI
Tab clear	^ON
Justification on/off	^OJ
Line space setting	^OS
Page break display on/off	^OP
Ruler display on/off	^OT
Word wrap on/off	^OW
Dot command display on/off	^OD
Hyphen help on/off	^OH
Soft hyphen entry on/off	^OE

TEXT MANIPULATION BLOCK MOVEMENTS

Description	Command
Mark block beg.	^KB
Mark block end	^KK
Hide/display marked block	^KH
Copy block	^KC
Delete block	^KY
Move block	^KV
Write block to another file	^KW
Set/hide text marker 0-9	^K0-K9
Read another file into text	^KR
Copy file	^KO
Rename file	^KE

SEARCH & REPLACE

Description	Command
Find string	^QF
Find & replace	^QA
Find & replace again	^L

SAVING FILES

Description	Command
Abandon edit	^KQ
Save, re-edit	^KS
Save, done edit	^KD
Save, exit to operating system	^KX

PRINTER CONTROLS

Description	Command
Alternate pitch (12)	^PA
Boldface beg./end	^PB
Double strike beg./end	^PD
Non-break space	^PO
Overprint next char.	^PH
Overprint next line	^P RETURN
Print pause	^PC

PRINTER CONTROLS (Continued)

Description	Command
Ribbon color change	^PY
Standard pitch (10)	^PN
Strikeout beg./end	^PX
Subscript beg./end	^PV
Superscript beg./end	^PT
Underscore	^PS
Phantom space	^PF
Phantom rubout	^PG
User printer controls	^P Q, W, E, R

MISCELLANEOUS COMMANDS

Description	Command
Delete a file	^KJ
Interrupt	^U
Print a file	^KP
Set help level	^JH 0, 1, 2, or 3
Log disk drive	^KL A:, B:, etc.
File directory on/off	^KF
Repeat next command	^QQ
Enter control character	^P any contrc character

DOT COMMANDS

Description	Command
Bidirect. print on/off	.BP
Microjustify on/off	.UJ
Page offset	.PO
Character width	.CW
Comment (not printed)	.IG or . .
Conditional page	.CP
Footing	.FO
Footing margin	.FM
Heading	.HE
Heading margin	.HM
Line height	.LH
Margin at bottom	.MB
Margin at top	.MT
New page	.PA
Omit page no.	.OP
Page number	.PN
Page no. column	.PC

DOT COMMANDS (Continued)

Description	Command
Subscript/superscript roll	.SR
Paper length	.PL

MERGE-PRINT DOT COMMANDS

Description	Command
Data file	.DF
Read variables	.RV
Repeat	.RP
Set variable	.SV
Ask for variable value	.AV
Display message	.DM
Clear screen	.CS
File insert	.FI
Print-time line forming	.PF
Right margin	.RM
Left margin	.LM
Line spacing	.LS
Output justification	.OJ
Interpret input as justified	.IJ

CHARACTER PITCH

Pitch (characters per inch)	Dot Command
5	.CW 24
6	.CW 20
7	.CW 17
8	.CW 15
10	.CW 12*
12	.CW 10
15	.CW 8
20	.CW 6
24	.CW 5
30	.CW 4

*default

LINE HEIGHTS

Lines per inch	Dot Command
2.0	.LH 24
2.4	.LH 20
2.6	.LH 18
3.0	.LH 16
4.0	.LH 12
4.8	.LH 10
5.3	.LH 9
6.0	.LH 8*
6.8	.LH 7
8.0	.LH 6
9.6	.LH 5

*default

Note: dot command values must be in whole numbers.

SuperCalc Reference Card

SuperCalc™ has been designed to get the maximum power of a microcomputer by using a minimum number of commands. Special data entry, display, and editing capabilities give you the flexibility that you need. Special features, such as interpretive prompting, English-language error messages, and the unique Answer Key™ (help function) make SuperCalc easy to use. SuperCalc is the planning tool that combines flexibility *and* simplicity so that you can make the best decisions for every situation.

SuperCalc Entries

/ --- To enter a Command.
= --- To specify a cell to jump to.
! --- To force recalculation.
; --- To split or unsplit window display.
↑ or **CTRL/E** --- To scroll up worksheet.
↓ or **CTRL/X** --- To scroll down worksheet.
← or **CTRL/S** --- To scroll left on worksheet.
→ or **CTRL/D** --- To scroll right on worksheet.
If your terminal does not have UP/DOWN arrows, using the space bar (once) will toggle the meaning of RIGHT/LEFT arrows between RIGHT/LEFT and UP/DOWN.

CRTL/Z --- To blank current entry line.
CR = Carriage return key
Maximum characters per entry = 116

Editing Features

When entering data, a quote mark (") begins a text string; an apostrophe (') begins a repeating text string; and any other character begins a formula or numeric input.
In addition, the arrow keys which normally scroll the worksheet become "editing" keys. Use:

← or **CTRL/S** --- To backspace one character.
→ or **CTRL/D** --- To move right one character.
↑ or **CTRL/E** --- To insert one blank character.
↓ or **CTRL/X** --- To delete one character.

Cell References and Ranges

A cell reference is a column-row coordinate that refers to the address (location) or each individual cell, such as **A1**, **B4**, etc.

Instead of typing the coordinate of a cell, you can point to it by pressing the ESC (escape) key. SuperCalc responds by typing a reference to the current cell, and allows you to use the arrow keys to point to any cell that you want. Another ESC will return arrow keys to their editing functions.
Some commands and functions in formulas accept cell "ranges". A range is two cell coordinates that are separated by a colon (:). e.g.:

A1:A10 is a column range or partial column.
B10:10 is a row range or partial row.
D5:H12 is a block range.
In a command, (**CR**) when asked for a range (or cell or column or row) means CURRENT cell or column or row.

Formulas

Formulas consist of numbers, references to other cells, functions separated by operators and parantheses.

\+ addition
\- subtraction
* multiplication
/ division
↑ raising to a power
< is less than
> is greater than
= is equal to
<> is not equal to
<= is less or equal to
>= is greater than or equal to

Maximum number = 16 characters
Maximum text = 116 characters
Maximum mathematical expression = 116 characters

Numbers may be integer (5), decimal format (12.82), or scientific notation (1.6e14).

Arithmetic Functions:
Operates on lists of expressions and ranges.

SUM Supplies the total value of the list.
COUNT Supplies the number of non-blank, non-text cells described by the list.
AVERAGE Supplies the SUM of the list divided by the count of the list.
MIN Supplies the lowest value of all entries in the list.
MAX Supplies the greatest value of all entries on the list.
INT Supplies the integer (non-fractional part) of a number.
ABS Supplies the absolute value (number with any minus sign removed).

Conditional Expression:
Expression is any formula. The IF function results in either the value of *formula 1* or *formula 2*.

IF (*expression, formula 1, formula 2*)
formula 1 is used if *expression* is "true" (non-zero); otherwise, formula 2 is used.
OR (*expression 1, expression 2*)
OR results in "true" (value of 1) if either *expression 1* or *expression 2* are "true" (non-zero); otherwise, results in "false" (value of 0).

AND (*expression 1, expression 2*)
AND results in "true" (value of 1) if both *expression 1* and *expression 2* are "true" (non-zero); otherwise, results in "false" (value of 0).
NOT (*expression*)
Not results in "true" (value of 1) if *expression* is "false" (zero); otherwise, results in "false".

Trigonometric Functions
SIN, COS, TAN, ASIN, ATAN, EXP, SQRT, LN, LOG10, PI

Miscellaneous Functions
ERROR, NA, LOOKUP, NPV

Current Cell Shorthand
The current-cell (ESC) can also be used to enter the current cell, column, or row into the command line. Once you press the **ESC** key, you can move the Active Cell temporarily to a new location. Its address changes on your entry line and can be used in your command. Pressing ":" allows you to develop two cell addresses, such as B5:E5. Pressing **ESC** again reverts to normal mode to allow arrow-key editing.

SuperCalc Commands

/ **B**(lank) , range **CR**
Removes contents of all unprotected cells in specified range, or single cell.

/ **C**(opy) , range , destination cell { **CR** / ,**N**(o Adjust) / ,**A**(sk for adjust) / ,**V**(alues) }
Copies contents of range of cells to another address on the worksheet.

/**F**(ormat) { **G**(lobal) / **C**(olumn) / **R**(ow) / **E**(ntry) } { **I**,**G**,**E**,**$**,**R**,**L**,**TR**,*,**D** / column letter / row number / cell address } width **CR**
Changes the display format of cells, columns, rows or entire worksheet.

Format Options:
I(nteger)
Displays numbers rounded to a whole number.
$
Displays numbers with two digits following a decimal point.
E(xponent)
Displays numbers in scientific notation.

Formula Adjustment Options:
Determines how cell references in formulas are adjusted for their new positions during **COPY**, **LOAD**, or **REPLICATE**. If no option is requested, all references are adjusted.

N(o Adjust)
Leaves all cell references unchanged.

A(sk)
Allows specified adjustment or no adjustment of individual cell references.

V(alues)
Moves only the current value(s) of specified cells.

/ **D**(elete) · { **R**(ow) / **C**(olumn) / **F**(ile) } { row # / column letter / file name }
Deletes specified cell, row, column, or range.

/ **E**(dit) , source cell , **CR**
Allows editing the contents of a cell.

G(eneral)
Displays numbers as they "best fit" into a cell.

*
Displays numbers graphically as a string of stars.

R(ight)
Formats numbers to be right-justified.

L(eft)
Formats numbers to be left-justified.

T(ext)**R**(ight)
Displays text strings right-justified.

T(ext)**L**(eft)
Displays text strings left-justified. (Long text will continue to display in unoccupied adjacent cells.)

D(efault)
Resets "window" (video display) to **G**(eneral) format, **R**(ight) justified numbers, and **T**(ext)**L**(eft) justified.
In addition, while formatting Global or Column, a column width or 0-127 may be specified.

/ **G**(lobal) { **N**(ext) / **B**(order) / **T**(ab) / **R**(ow) / **C**(olumn) / **M**(anual) / **A**(uto) }
Changes Global *display* or *calculation* options. These options affect calculation or display attributes.

Calculation Options:

R(ow-wise)
Specifies that calculation of worksheet be done by row; that is, all of Row 1, then all of Row 2, etc., *OR*,

C(olumn-wise)
Specifies that calculation of worksheet be done by column; that is, all of Column A, then all of Column B

A(utomatic Calculation)
Specifies calculation of worksheet be done after each number is entered, *OR*

M(anual Calculation)
Specifies calculation of worksheet be done only when you enter "!".

Display Options:

B(order)
Controls whether or not the Row numbers and column letters are displayed (regardless of window scrolling)

F(ormula Display)
Controls whether or not the actual formulas or the current values are displayed.

N(ext)
Controls whether or not the cursor automatically advances (to the next cell in the "current direction") after data is entered into a cell.

T(ab)
Controls whether or not empty or protected cells are skipped during cursor advancing.

/ **I**(nsert) [, **R**(ow) , row # | **C**(olumn) , column letter] **CR**

Creates a blank space for a new row or column.

/ **L**(oad) , file name , { **A**(ll) | **P**(art) , source range , destination cell } { **CR** | , **N**(o Adjust) | , **A**(sk for adjust) | **V**(alues) }

Reads worksheet (or portion) from the disk.

Load Options:

A(ll)
Loads entire worksheet, and resets global column row formats, column widths, display mode settings, etc., from saved worksheet; *OR*

P(art)
Loads any portion of saved worksheet into any portion or current memory worksheet. Global flags and settings are not affected.

/ **M**(ove) , [**R**(ow) , from row # , to row | **C**(olumn) , from column letter , to column letter] # **CR**

Moves (either) rows and/or columns to a new location on the worksheet.

/ **O**(utput) , [**D**(isplay) | **C**(ontents)] , Range , { **P**(rinter) | **S**(etup) | **C**(onsole) | **D**(isk) , file name **CR** }

Displays contents or values of cells onto the disk, console or printer.

Output Report Options:

D(isplay)
Generates reports formatted in rows and columns; essentially like the interactive display.

C(ontents)
Lists the exact contents (text or formulas), rather than current values of occupied cells, one per line.

Output Device Options:

P(rinter)
Allows reports to be printed from the worksheet using the setup codes and page dimensions originally configured when **SuperCalc** was installed.

S(etup)
Prints reports as "**P**", but allows special printer setup codes, or page dimensions.

C(onsole)
Allows you to preview a report on your terminal display.

D(isk)
Outputs the report to a disk file for later use.

/ **P**(rotect), range **CR**
Prevents alteration of current contents in single cell, or range of cells.

/ **Q**(uit) , [**Y**(es) | **N**(o)]
Supplies option to exit *SuperCalc*. This discards all worksheet data not saved on the disk.

/ **R**(eplicate) , source range , destination range { **CR** | **N**(o Adjust) | **A**(sk for adj | **V**(alues) }

Reproduces current partial rows and/or columns to another location on the worksheet.
Options are same as **C**(opy)

/ **S**(ave) , [file name | **CR** for directory] , [**A**(ll) | **V**(alues)]

Writes current worksheet data onto the disk.

Save Options:

A(ll)
Saves text, formulas, and current values for the

entire worksheet onto the disk.

V(alues)
Saves *only* the text and the current values of formulas for the entire worksheet.

/ **T**(itle) , { **H**(orizontal) / **V**(ertical) / **B**(oth) / **C**(lear) }

"Locks" colums and/or rows so that they do not scroll off the window (or video screen).

Title Lock Options:

H(orizontal)
Locks current row and all rows above it.

V(ertical)
Locks current column and all those to the left of it.

B(oth)
Locks both **H**(orizontal) and **V**(ertical) simultaneously.

C(lear)
Erases all "Locks".

/ **U**(nprotect), range **CR**
Allows alteration of protected data in single cell, or range of cells.

/ **W**(indow) , { **H**(orizontal) / **V**(ertical) / **C**(lear) / **S**(ynchronized) / **U**(nsynchronized) }

Splits or unsplits the screen display, depending upon which command is used in conjunction.

Window Options:

H(orizontal)
Splits current screen display into two windows at current row.

V(ertical)
Splits current screen display into two windows at current column.

C(lear)
Erases split windows. (Return to single display window.)

S(ynchronize)
Causes both windows to scroll simultaneously when moving parallel to split.

U(nsynchronize)
Causes only current window to scroll, regardless of direction.

/ **Z**(ap) , { **Y**(es) / **N**(o) }

Supplies option to erase all data from the worksheet, including Global formats and column widths.
"/ **Z**(ap)" resets SuperCalc to original *default* settings.

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Que Microcomputer Products

Title	Item No.	Date Available
BOOKS:		
Apple II Pocket Dictionary	0-88022-023-6	Early '83
Apple II Word Processing	0-88022-005-8	Currently
C Programming Language	0-88022-022-8	Spring '83
CP/M Word Processing	0-88022-006-6	Currently
IBM PC Expansion & Software Guide	0-88022-019-8	Currently
IBM PC Pocket Dictionary	0-88022-024-4	Early '83
IBM's Personal Computer-hbk.	0-88022-101-1	Currently
IBM's Personal Computer-pbk.	0-88022-100-3	Currently
The Osborne Portable Computer	0-88022-015-5	Currently
SuperCalc;SuperModels for Business	0-88022-007-4	Jan. '83
Timex/Sinclair 1000 User's Guide	0-88022-016-3	Currently
VisiCalc Models for Business	0-88022-017-1	Jan. '83
SOFTWARE:		
CalcSheets for Business	1100 Series	Jan. '83

"CalcSheets for business" is a series of VisiCalc and SuperCalc models to assist business people in cash management, debt management, fixed asset management, working capital management, and other business management. These models run on the IBM Personal Computer, Apple II computer and other popular personal computers.

The Osborne computers represent a new level of "personal" in personal computing by providing more portability then ever before at a dollar value that is unmatched in the industry. This places personal computing within the reach of more users and encourages the development of the entire computer industry.

Osborne's computers utilize CP/M, the operating system which is the most popular in microcomputing at this time. Using the CP/M operating system means there are many applications software packages (accounting, word processing, etc.) available to run on the Osborne portable computers.

Attractive hardware pricing is supplemented by free (bundled) high quality applications software such as WordStar and SuperCalc. Osborne also provides several popular languages at no extra charge.

This book is an objective (third party) description of the Osborne computers in their entirety—including both hardware and the free software. Neither the author nor the publisher have any interest in Osborne computers except to provide useful information to prospective users.

If you own or plan to purchase a personal portable computer, this book is your best source of unbiased, practical information about the Osborne computers.

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